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COLLECTIVE REVIEW

GAS GANGRENE

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MANY of the great men of medicine have been interested in gas gangrene as a complication of wounds because of its spectacular nature, fulminating course, profound toxemia, mutilating effects, and high mortality. Hippocrates described very vividly a fulminating infection of the leg which appears to have been gas gangrene and Celsus also seemed to have recognized its occurrence. Thereafter the disease apparently was not recognized for a long time and Avicenna, Guy de Chauliac, J. de Vigo, and Ambrose Paré (12) did not refer to it although they observed many wounds. In 1745 Quesnay attributed the first exact observations on gas gangrene to Peyronnie, who described the "subcutaneous emphysema, the erysipelatous color of the skin, and the rapidity of death." In 1746, Fabricus de Hilden also published one of the earliest clinical descriptions and expressed his belief that "the principal cause of this terrible ill is some venomous humor which Nature has driven into these people." Later Dupuytren described a condition of "spontaneous emphysema" occurring in trauma and resulting in rapid decomposition of the injured part. In 1786 Thomas Kirkland recognized the disease and called it gangrene of the "emphysematous type." Early in the nineteenth Century, Larrey, the leading surgeon of the Napoleonic wars, described the rapid progress of gangrene which spread from the injured limb in a few hours and often caused death in less than 10 hours. To prevent this complication of wounds, which he called "traumatic gangrene," he advocated early amputation of mangled extremities. Boyer (1814), Velpeau (1829), Martin de Bazas (1836), and Malgaine all stressed its occurrence as a complication of fractured limbs. Chassaignac (1849-50) believed that certain gangrenes with emphysema had "a poison far in excess of the mechanical injury" and called it "empoisonnement traumatique." Billroth thought that the decomposition of mortified elements, possibly by the action of some ferment, was the cause of this condition, which he referred to as "primary mephitic gangrene." Maisonneuve in 1853 named it "gangrene foudroyante" and at this time some believed the disease had its inception as a clinical entity. During the Crimean War, Pirogoff and Salleron wrote of this condition, and in the Franco-Prussian War, it was reported by Wyatt, Frery, and Passow. However, for some unexplained reason not a single case was recorded by Keen during the American Civil War.

Shortly thereafter, during the "bacteriological era," the bacterial cause of this disease was established and the more important causal bacteria were identified by various workers, Louis Pasteur discovering the Vibrion septique, Novy the Clostridium oedematiens, and Welch the Clostridium welchii.

There is evidence that the incidence of gas gangrene has been significantly increased during more recent times, presumably because a high percentage of the wounds in modern wars has been produced by high explosive shells, bombs, and land mines. According to Zeissler, 100,000 German soldiers died of this complication during the first World War. In the more recent Ethiopian and Spanish Wars, gas gangrene was relatively infrequent, but with the advent of active fighting in

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Europe in 1939 and 1940, its incidence increased, varying between 0.7 and 1.8 per cent.

PREDISPOSING FACTORS

Location of the wound. There are many factors which have been found to predispose to the development of clostridial infections. The location of the wound is of considerable importance since the various tissues of the body are known to have different powers of local resistance, and the resistance of these tissues also varies with their location. The muscular areas of the thigh, calf, and buttock are especially susceptible, while the face, scalp, back, and thorax are affected infrequently (2, 99, 107, 124, 168). In a series of 607 cases collected by Millar from civilian life between the beginning of the "Post-Lister" period and 1930, the known sites of injuries developing gas gangrene were the lower extremities in 47.6 per cent, the upper extremities in 22.6 per cent, undesignated extremities in 11.3 per cent, the trunk and genitalia in 16.3 per cent, and the head or neck in 2.4 per cent.

The legs have been most often affected because of their large masses of muscular tissue which are subject to traumatization and growth of the clostridia, their susceptibility to injury of the arterial circulation, and the likelihood of contamination by dirt and fecal matter (80). All parts of a given region have not been equally susceptible. Trueta pointed out that gas gangrene developed in the thigh most commonly from wounds in the upper third, less often from wounds in the middle third, and least often from wounds in the lower third. Furthermore, it occurred more commonly in wounds of the front of the thigh. In the arm there appeared to be less distinction between one part and another.

Age. The highest incidence of gas gangrene has been in the age groups between 10 and 39 years, the ages that are commonly exposed to the physical hazards of life (124).

Sex. The ratio of males to females in civilian practice (124) was about 5.7 to 1.0, while in military practice the cases were confined almost entirely to males for obvious reasons.

Season. Maes found that gas gangrene occurred more frequently in the colder than in the warmer months of the year, and he believed that clostridial contamination of wounds by woolen clothing worn more frequently in cooler months was the explanation.

In Millar's series, however, this variation according to season was not apparent, the incidence being approximately the same for the four seasons of the year.

Geographical location. Areas which have been repeatedly cultivated over several or more centuries have produced a higher incidence of gas gangrene than noncultivated areas. This was supported to a certain extent by MacLennan's observations upon the anaerobic bacterial flora of samples of soil taken from the African desert and from the cultivated environs of some coastal towns (107). MacLennan also pointed out that the incidence of gas gangrene increased from 3.4 per 1,000 wounded to approximately 6 or 7 per 1,000 wounded when the fighting moved from the Western Desert to the more cultivated areas of Tripolitania and Tunisia.

General physical condition. Reduction in the patient's general powers of resistance by shock, fatigue, exposure, continued pain, hunger, malnutrition, loss of blood, and certain metabolic diseases such as diabetes and arteriosclerosis has increased his susceptibility to clostridial infection (3, 43).

EXCITING FACTORS

Type of wound. Certain types of wounds, such as compound fractures, gunshot and high explosive wounds, fracture dislocations, extensive lacerations, or crushing injuries containing torn devitalized muscle and dirt, have been particularly prone to develop gas gangrene (26, 145, 182). The presence of foreign bodies, such as dirt, gravel, cinders, bits of clothing or fragments of wood, metal, or glass, has seemed to enhance the virulence of contaminating clostridia. This has been clearly demonstrated experimentally in a recent study of gas gangrene in animals by Altemeier and Furste (10) who found that the minimum lethal dose of a standardized strain of Clostridium welchii was decreased 1,000 times in the presence of devitalized muscle, and 1,000,000 times in the presence of crushed muscle and dirt. In other words, it took only one-millionth as many bacteria to produce a fatal gangrenous infection in the presence of devitalized muscle and dirt as it did when bacteria were injected into healthy muscle.

The association of gas gangrene and fractures is well known. In the American Expeditionary Forces of the first World War, there were 1,329 cases of gas gangrene among the 25,272 cases of fracture of bone, an incidence of 5.2 per cent (26). In Millar's series, 60.9 per cent of the cases collected from civilian life occurred in individuals with fractures.

Other forms of trauma that have precipitated this complication are cutaneous thermal burns (52, 114), and various operations including appendectomies, genitourinary operations, resections

for neoplasm, hernioplasty (124), biliary tract operations (1), abortions (44), instrumental deliveries, hypodermic injections (81, 119), and seemingly clean surgery, particularly amputations for arteriosclerotic or diabetic gangrene.

Although it may occasionally follow quite trivial injuries, it is most likely to develop in wounds with the following features:

1. Extensive devitalization of muscles, particularly in the extremities.
2. Interference of the main blood supply to a limb or muscle group, produced by injury, prolonged application of a tourniquet, tight packing, or application of constricting bandages, splints, or casts.
3. The presence of foreign bodies, clothing, or dirt deep in the tissues.
4. Delay in surgical treatment.
5. Puncture wounds with considerable hemorrhage or retained foreign bodies (182).

Certain muscles derive their blood supply from one or two main sources, and this is true particularly for the gluteus maximus, hamstring, rectus femoris, vastus intermedius, and gastrocnemius muscles. Massive devitalization of tissue produced by any crushing, lacerating, or penetrating wound which impairs or destroys these sources of blood supply enhances the occurrence of gas gangrene. Power has pointed out that the re-establishment of the collateral circulation of ischemic muscle appears to be extremely slow and that muscle deprived of its blood supply for 6, 8, or more hours frequently dies. MacLennan (108) found that in 28 of 44 cases of gas gangrene in the Tripolitania and Tunisia campaigns, a major artery had suffered severe trauma.

Type of projectile. Trueta, Lenner, and Mullally observed that the nature and form of the projectile producing a wound played an important etiological role. Rifle, pistol, and machine gun bullets, particularly those that retain their proper shape, seldom produced this complication, while bullets mishapened either deliberately or by ricochet were more prone to produce clostridial infections. Injuries caused by bombs, shells, or trench mortar grenades were prone to precipitate gas gangrene because of the irregular shape of the wounds, the extensive damage to the soft tissues, and the impairment of both the local and general circulation.

Improper surgical care. Improper surgical care of wounds may be a very potent factor in the development of gas gangrene because of the resultant formation of devitalized tissue in a wound. The prolonged application of a tourniquet may produce ischemia and necrosis of muscle, thereby giving any bacteria that are present an excellent opportunity to proliferate (151). A delay in initial surgical care for the men wounded in skirmishes between patrols in Tripolitania and Tunisia resulted in an incidence approximately 4 times greater than that for those injured in pitched battle (106). Delayed definitive treatment may actually permit the inception of gas gangrene, while inadequate débridement, primary closure of incompletely débrided wounds, tight packing of wounds, closure under tension, and application of improperly fitting casts or splints may favor the development of devitalized tissue and gangrenous clostridial infections (68). Plaster-of-paris casts may be particularly dangerous when applied under conditions which do not permit close observation of the patient afterward, and when the cast has not been bivalved or split to allow for subsequent swelling of the tissues (74).

BACTERIAL ETIOLOGY

Gas gangrene is a clinical entity of multiple bacterial etiology produced by a great variety of gas-producing anaerobic bacteria, chiefly the Clostridium welchii, Clostridium oedematiens, Clostridium septique, Clostridium histolyticus, and Clostridium sporogenes. Other clostridia described include the clostridia fallax, tertium, putrificum, aerofetidus, bifermentans, capitovale, and sphenoides (8, 26, 54, 76, 107, 123, 167). The individual case usually presents a mixed bacterial flora and aerobic pathogenic cocci and bacilli have been found to coexist with the anaerobes in more than half of the cases. The different strains have varied symbiotic and synergistic relationships which are but little understood. The bacteria producing the initial infection in gas gangrene are but slightly proteolytic, and much of the tissue destruction and digestion that follow the gaseous infiltration and edema is thought to be due to proteolytic commensals, the most frequent and active of these being the Clostridium sporogenes (40).

Trueta reported the relative incidence of anaerobic bacteria in cases of gas gangrene studied by various men as follows:

	Weinberg and Seguin Per cent	McIntosh per cent	Henry per cent
Clostridium welchii	77	67.3	80
Clostridium oedematiens	34	4.0	10
Clostridium sporogenes	27	38.7	—
Clostridium fallax	16.5	—	6
Clostridium septique	13	16.3	13

According to Bates, the Clostridium welchii occurs in approximately 80 per cent of the cases of gas gangrene, the Clostridium septique in 10 per cent, and Clostridium oedematiens in 3 per cent.

It has become increasingly apparent that the relative incidence of the various clostridia in gas gangrene varies with the geographic location. In a carefully studied group of 146 cases of gas gangrene developing in war wounds in the Middle East (107), the incidence of the Clostridium welchii was much lower (56 per cent) than that given by other workers in Europe, while that of the Clostridium oedematiens was much higher (37 per cent). The occurrence of other bacteria in this series of MacLennan is well illustrated in Tables I and II.

However, in the more recent fighting in France, MacLennan and Macfarlane (109) later found that the Clostridium welchii was the most common single anaerobe in infectious gangrene, occurring in 24 of 27 cases studied by them and in more than 90 per cent of the German cases reported by captured German medical officers. They also believed that the anaerobic flora of the soil in Italy was very similar to that of Tunisia and Western Europe, and that approximately 60 per cent of the wounds contained clostridia, among which the Clostridium welchii and the Clostridium sporogenes were predominant.

Although the Clostridia welchii, oedematiens, septique, and histolyticum are recognized as the most important agents in the production of gas gangrene (26), the fact remains that the Clostridium welchii is the principal cause, being present either alone or in association with the other gas-producing anaerobes in from 56 to 100 per cent of the cases in the reported series.

Characteristics of the Clostridium welchii. This organism, first isolated in 1892 from a cadaver by Welch and Nutall, has acquired eleven synonyms (140), the most frequently used of which are Bacillus perfringens, Clostridium welchii, and the gas bacillus. It is a short, thick, capsule-bearing bacillus with truncated ends and it is fairly ubiquitous in man's environment, being commonly present in soil, dust, sewage, milk, water, the intestinal and genital canals of man and animals, woolen clothing, and fur of domestic animals.

TABLE I.—INCIDENCE IN PER CENT OF PATHOGENIC ANAEROBIC BACTERIA FOUND IN 146 CASES OF GAS GANGRENE.

Species	Incidence in per cent
Clostridium welchii	56
Clostridium oedematiens	37
Clostridium septique	19
Clostridium histolyticum	6
Clostridium bifermentans	4
Clostridium fallax	1
Clostridium tetani	13
Streptococci	9

TABLE II.—INCIDENCE IN PER CENT OF NON-PATHOGENIC ANAEROBIC BACTERIA FOUND IN 146 CASES OF GAS GANGRENE.

Clostridium sporogenes	37
Clostridium tertium	30
Clostridium putrificum	19
Unidentified	16
Clostridium butyricum	13
Clostridium cochlearium	9
Clostridium capitovale	5
Clostridium sphenoides	3
Clostridium hastiforme	3
Clostridium tetanomorphum	2

Being one of the most hardy of all anaerobes, its most important characteristics include the production of a large amount of gas and powerful toxins during growth. Hemolysins for the blood corpuscles of man, rabbits, dogs, pigeons, white mice, hogs, cattle, sheep, horses, guinea pigs, white rats, and hens are formed (26). In the guinea pig, rabbit, hen, and pigeon, the hemolysins dissolve out the hemoglobins, while in the other animals, the red cells are destroyed. The seven toxins which have been described are listed below, but for practical purposes only the alpha, theta, and beta toxins need be considered since the existence of the others is based mainly upon inference (133, 167, 179).

1. Alpha toxin is a thermostabile lecithinase which splits lecithin and the lecithin group of lecithoproteins into phosphocholine and a diglyceride (106). Because of this property, it is hemolytic to the red cells of most experimental animals except the horse and goat, and its intravenous, intramuscular, or intraperitoneal injection is lethal to mice, guinea pigs, rabbits, pigeons, and sheep. Animals surviving more than a few hours after the intravenous inoculation of this toxin may develop a hemolytic anemia with hemoglobinuria. Subcutaneous injections produce a characteristic necrotic lesion.

2. Theta toxin is a lethal toxin which is vigorously hemolytic for the red cells of most laboratory animals except those of the mouse. Being oxygen-labile, thermolabile, and readily neutral-

TABLE III.—THE INCIDENCE OF THE CLOSTRIDIUM WELCHII IN CASES OF GAS GANGRENE

Observer	Percentage Incidence of Cl. Welchii in Gas Gangrene
Babcock	72
Bates	About 80
Boyd	70–80
Cruickshank, R.	70–80
Gins and Koeppen	96
MacLennan (107)	56
Weinberg, M., and Seguin, P. (180)	85
Kukin	100

ized by cholesterol, it is similar to streptolysin O, to which it is closely related antigenically.

3. Eta toxin is a lethal toxin without necrotizing or hemolytic activity which has been differentiated from alpha toxin by discrepancies in the neutralizing values of sera as determined by necrotizing and lethal testing.

4. Beta toxin is a thermolabile, lethal, and necrotizing toxin which can be recovered from the intestinal tract of lambs suffering from "lamb dysentery."

5. Gamma toxin is a lethal toxin without hemolytic or necrotizing power, the existence of which has been inferred because of discrepancies between the neutralizing values of various specific sera when tested against corresponding filtrates.

6. Delta toxin is lethal and hemolytic for the red cells of sheep, pigs, goats, and cows, but does not affect human serum or manifest any necrotizing activity.

7. Epsilon toxin is a lethal and necrotizing toxin which exists in two forms, thermostable and thermolabile. In its thermolabile form it has occurred in the intestinal contents of sheep suffering from lamb dysentery and infectious enterotoxemia, and the disease is almost certainly due to absorption of toxin from the alimentary canal.

Recently MacFarlane and MacLennan (109) have described further activities of Clostridium welchii toxin which may be very significant. In observations made on muscle taken from the site of clinical infection or following the intramuscular injection of toxin in rabbits, they obtained evidence of a marked increase of extractable fat in such muscles which was due, perhaps, to the release of intracellular lipoids. By the incubation of rabbit and human muscles with Clostridium welchii toxin and toxin neutralized by antitoxin, they were also able to demonstrate that the toxin produced a friable mass of loose brittle fibers which they designated as collagenase activity. This activity was not demonstrated for the toxins of clostridia oedematiens and septique. They believed that there were possibly two toxic factors involved in gas gangrene, one derived from the bacteria, which can be neutralized by antitoxin, and another derived from disintegrating tissues, which can be prevented from killing the patient only by surgical removal of the tissues concerned. Studies at Cincinnati in experimental gas gangrene have also been indicative of a secondary toxin arising from the disintegration of tissue. This hypothesis received some support from the observations that the anaerobic cellulitis due to clostridia welchii and welchii infections of the brain and serous lined cavities (140) is not associated with the profound toxemia observed in cases of Clostridium welchii myositis. This naturally leads to the question of a possible relationship between the effects of a toxic destruction of muscle and those associated with its traumatic destruction. In both conditions there is circulatory failure, liability to renal involvement leading to uremia, and, perhaps, fat embolism. In this connection, Cooke *et al.* have described 2 fatal cases of gas gangrene which showed extensive fat embolism of the lung and other organs at autopsy. It would seem profitable to focus attention on the collagenase activity of the toxin of the Clostridium welchii.

The knowledge that the Clostridium welchii occurs frequently in wounds in which no symptom of gas gangrene is observed has led to the assumption by some that many of the Clostridium welchii strains are atoxic. Robertson and Keppie investigated 26 strains of the Clostridium welchii obtained from wounds with gas gangrene, wounds with clostridial infection but without symptoms of gas gangrene, and wounds without evidence of clostridial infection. Their studies indicated that all of the strains tested seemed to be of a basic toxicity sufficient to produce gas gangrene if the state of the wound was such as to permit their rapid proliferation and the evolution of toxins.

In a recent study at Cincinnati (10), the virulence of 15 strains of the Clostridium welchii isolated from dirt was determined quantitatively and compared with that of 25 strains isolated from wounds manifesting gas gangrene, localized clostridial infections, or nonspecific low grade infections. The results of this study were as follows:

1. The virulence of strains isolated from infected wounds for as long as 3.5 years was from 1,000 to 1,000,000 times greater than that of strains isolated from dirt, clothing, and soil.

2. The virulence of the types isolated from localized infections and low grade infections in some instances was as high as that of strains obtained from the fulminating cases.

3. There was no measurable correlation between the virulence of these strains for experimental animals in closed wounds containing crushed muscle and dirt and their relative ability to produce alpha toxin, theta toxin, and hyaluronidase in vitro.

4. The virulence as determined by the crushed muscle and dirt technique did not correspond with that determined by the simple injection of bacteria.

After a study of more than 600 strains of the Clostridium welchii isolated from cases of abortion, Butler (24) concluded that the strains caus-

ing severe infections differed both in regard to growth characteristics and to the amount of capsular material they produced in broth.

Woods and Fein studied the metabolism of amino acids in one strain of the gas bacillus, and, found that it attacked only 5 of 21 commoner amino acids which they investigated; these acids included serine, cystine, thaeonine, and arginine.

Observations upon animals infected with pure cultures of the Clostridium welchii have thrown much light on the pathogenesis of gas gangrene. The injection of large quantities of washed bacilli failed to produce gas gangrene in animals unless relatively large amounts were used. Characteristic lesions, however, were produced readily if a slight injury to the muscles preceded the injection of bacteria (10, 25, 26, 147, 167). In the presence of devitalized muscle, the inoculation of a virulent culture of Clostridium welchii is typically followed by local swelling and induration within from 4 to 6 hours, which increases rapidly. Crepitation often becomes perceptible within 6 or 8 hours. The swelling is caused chiefly by edema, and to a lesser extent by infiltration of gas. The symptoms of intoxication that develop include extreme rapidity of the pulse and respiration, prostration, slight convulsions, and paralysis of the bowel. Before death, the animal has paralysis of its hind legs and convulsive contractions.

Characteristics of the Clostridium septique. This organism, originally described by Pasteur and Joubert in 1877, normally lives in the soil and is a nonproteolytic, very saccharolytic bacillus which produces powerful exotoxins including a hemolysin and a hemagglutinin. It produces less gas than the Clostridium welchii and an edema which, although highly hemorrhagic, is soft, compressible, and less extensive and gelatinous than that produced by the Clostridium oedematiens. Small vesicles containing serosanguineous fluid appear on the skin. The muscles infected by this organism are rendered soft and intensely red during the first few hours. It hemolyzes the red corpuscles of the guinea pig, rabbit, sheep, goat, and man (26). The pathogenicity of different strains varies considerably. Areas of swelling and induration develop fairly rapidly in rabbits and guinea pigs after the injection of the Clostridium septique but they are never as extensive as those produced by the Clostridium welchii.

The studies of Bernheimer suggest that the hemolytic and lethal actions of crude toxin are either functions of a single substance or of two substances having a similar physical, chemical, and antigenic property.

Characteristics of the Clostridium oedematiens. This organism was probably first discovered by Novy in 1894 in a study of "malignant edema" in guinea pigs. The bacterium lives in the soil and produces a highly aggressive exotoxin which destroys the red corpuscles of man, sheep, and guinea pigs (26). The organism is saccharolytic and produces little or no gas. Apparently it does not invade the tissues and, hence, like the Clostridium tetani and the Bacillus diphtheriae, its poisonous effects are due entirely to its toxin (167), which is highly invasive and kills animals within 48 hours after intravenous injection.

The lesions produced by different strains of the Clostridium oedematiens vary according to their powers of toxin production. The intramuscular inoculation of a toxin producing strain is followed quickly by marked swelling of the limb which increases by the hour. As the firm elastic edema extends upon the abdomen, the thigh becomes cold and the skin pale and bluish. The muscles at the site of injection become congested and infiltrated with a gelatinous, deep pink fluid and many fine gas bubbles, but no putrid odor develops. Subcutaneous injection produces a similar lesion with a very thick, lardlike edema infiltrating the subcutaneous connective tissue for a depth of from 3 to 4 cm.

Characteristics of the Clostridium histolyticus. This organism, the most proteolytic of all the anaerobes, is pathogenic to varying degrees for all laboratory animals, including guinea pigs, rabbits, white mice, and rats (26). A guinea pig will die several minutes after an intravenous injection of from 1 to 2 c.c. of a 24 hour culture, and an intraperitoneal injection is lethal in the same dose. Intramuscular injection is followed immediately by violent tetany of the muscles about the head and neck, and within several hours by local swelling and redness of the skin. A hemorrhagic layer develops in the subcutaneous connective tissue, and the subcutaneous and perimuscular connective tissues undergo rapid digestion. As the process continues for several or more hours, the digestion of the perimuscular connective tissue becomes more evident, and the muscles and the muscular bundles become dissociated and liquefied.

The Clostridium histolyticus, as well as the Clostridium fallax, and Clostridium sporogenes, does not seem to be sufficiently aggressive to produce gas gangrene clinically by itself.

CLOSTRIDIAL CONTAMINATION OF WOUNDS

Sources. It has been established that the Clostridium welchii is practically ubiquitous in the human environment. Even the dust collected

from various parts of a battleship by Endo was contaminated by pathogenic strains of the Clostridium welchii in 48.4 per cent of 31 samples in the first collection and 59.5 per cent in the second. The soil of countries that have been cultivated for centuries has always been heavily contaminated with clostridia. Recently Altemeier and Furste collected 15 samples of dirt from the major street intersections of Cincinnati and found that all samples contained viable spores of the Clostridium welchii as well as of other clostridia. MacLennan (107) found that Clostridium welchii was present in 22 of 26 samples obtained from cultivated areas of the African desert, in 6 of 24 samples from soiled areas, but in only 1 of 41 samples collected from unsoiled areas. Similar but less striking results were obtained with the other clostridia.

Wool clothing is an important source of clostridial contamination and the observations that the uniforms of wounded soldiers harbored the Clostridium welchii and other clostridia in a high percentage of instances (51, 107, 165) led to the assumption that this was principally the result of soil contamination. However, reports by Gage, Maes, and Altemeier (10), indicated that clothing made from wool naturally harbors the Clostridium welchii and other anaerobic gas producing bacteria.

Other less common sources of contamination have been unsterile and imperfectly sterilized dressings and instruments (40, 158), the unprepared skin of the abdominal wall (152), and even the ice used for refrigeration anesthesia (92).

Incidence. In view of its widespread distribution, the contamination of a considerable proportion of open wounds of violence is not surprising. Recent studies of the bacterial flora of various types of wounds are summarized in the following table which shows that the presence of the Clostridium welchii varied between 3.8 and 39.4 per cent. The average incidence of contamination in collected series of 3,027 wounds of violence, both civilian and military, was 14.7 per cent.

TABLE IV.—THE INCIDENCE OF THE CONTAMINATION OF WOUNDS OF VIOLENCE WITH THE CLOSTRIDIUM WELCHII.

Author	No. of cases	No. of wounds contaminated	Percentage of cases contaminated
Altemeier and Gibbs (11)	99	39	39.4
DeWaal, H. L.	708	27	3.8
Dimtza, A. and Gutscher, H.	424	57	13.4
Meleney (119) Soft part wounds	926	138	14.9
Compound fractures	674	147	21.8
Levaditi et al.	61	10	17
Miles (122) Military wounds	105	24	22.8
Spooner	30	3	10
	3027	445	14.7

CLOSTRIDIAL INFECTION

Incidence. In contrast to the relatively high incidence of contamination, the development of clinical gas gangrene in wounds is relatively infrequent. Its incidence has varied between 0.3 and 5.26 per cent in the following summary of collected series comprising 187,936 major open wounds, the average being 1.76 per cent.

This is especially remarkable since there is often no appreciable difference between the bacterial flora of the wounds developing gas gangrene and of those that do not (54). This brings up the very challenging question as to why only a small fraction of the wounds contaminated by clostridia develop gas gangrene.

According to Power, the answer undoubtedly is that only 0.33 per cent of all the wounds undergo

TABLE V.—THE INCIDENCE OF GAS GANGRENE IN WOUNDS OF VIOLENCE

Author	No. of cases	Number of cases which developed gas gangrene	Percentage of cases which developed gas gangrene
Altemeier (7)	71	3	4.2
Callender and Coupal			
Soft part wounds	128,265	1,389	1.08
Wounds including bone fracture	25,572	1,600	5.26
DeWaal	708	3	0.42
Fisher, Florey, Grimson, and Williams	3,471	5	0.15
Jeffrey (77)	About 2,000	5	0.25
Langley and Winkelstein	6,000	96	1.6
Lenner	750	18	2.4
MacLennan (108)	About 6,800	44	0.6 to 0.7 (British Campaign in Tripolitania and Tunisia)
Neel and Cole Pacific area (Author's) cases	984	7	0.71
Power	6,000	20	4.3
Ross and Ryan	1,815	82	0.5
Tuchel and Curcumeli	2,500	20	0.8
Wan (175)	3,000	17	0.6
	187,936	3,300	1.76

sufficient arterial damage to produce an adequate amount of ischemic muscle in which the clostridia can multiply. Although this factor is of importance, the answer does not appear to us to be this simple. Fleming pointed out that the infecting agent has often acquired increased virulence in passing from one individual to another in civilian practice, whereas the virulence of the agents infecting war wounds has been more than likely attenuated by the unfavorable surroundings under which they existed.

PATHOLOGY

There is still considerable confusion regarding the classification and interpretation of the pathologic changes in clostridial infection. A large number of descriptive terms has been applied to it, such as subcutaneous emphysema, primary mephitic gangrene, traumatic gangrene, bronze erysipelas, spontaneous emphysema, empoisonnement traumatique, and gangrene foudroyante. More recently, terms such as clostridial myositis, anaerobic cellulitis, anaerobic toxemia, and toxic edema have appeared.

The term gas gangrene is inadequate and undesirable in many respects, and the following classification is more desirable:

1. Clostridial myositis
   a. Spreading or diffuse (gas gangrene)
      1. Crepitant
      2. Noncrepitant or edematous
      3. Anaerobic toxemia
   b. Localized myositis
      1. Crepitant
      2. Noncrepitant
2. Clostridial cellulitis (crepitant phlegmon or anaerobic cellulitis)

Clostridial myositis of the spreading or diffuse type represents true gas gangrene and it may be manifested clinically as the crepitant type, the noncrepitant or edematous type, the mixed type, or the profound toxemic type. Because of its mild and self limiting nature, localized clostridial myositis should not be considered as gas gangrene. Diffuse clostridial myositis is essentially an affection of the muscles, and the connective tissues may be comparatively little affected at first. The clinical and pathological pictures presented by this infection differ markedly in long and in segmented muscles (167), the spread, rapidity of evolution, and gravity of the process all being greater in the former. Three distinct zones in these lesions have been described by Trueta; these are:

1. A central or dead zone which consists of disintegrated muscle destroyed by trauma, organized clot, and a vast number of organisms.

2. A second or dying zone which contains devitalized muscle fibers covered by masses of bacteria and the products of infection. Their anatomical arrangement remains undisturbed although the fibers became separated by an exudate which is or is not packed with leucocytes, according to the type of infection. Local leucocytosis usually is associated with mixed infections.

3. A third or normal zone in which the muscle is normal, except for some cellular infiltration.

The causal bacteria are found more often in the lymph surrounding the muscle fibers than in the fibers themselves, and their spread is in a longitudinal direction rather than a transverse one. It is believed by some that the infection extends rapidly through the damaged muscle to the area where the circulation is still intact and the muscle fibers are normal, where it is temporarily checked. Thus, although the tissues of the first and second zones are quickly destroyed by the combined effect of the trauma and infection, the vitality of the third zone may temporarily prevent further spread of the process and permit successful treatment. Others believe that the process spreads primarily in the connective tissue in the intermuscular septa and surrounding veins and nerves (139). The studies of McNee and Dunn on the microscopic appearance of the advancing edge indicated that the bacilli spread up and down the muscle in the interstitial tissues, preceded by the exudation of a toxic fluid which separated the muscle fibers from the interstitial tissue and killed them, permitting their invasion by the bacteria. Krupp and Smith, working with Reed and Orr, confirmed the tendency of gas gangrene to spread in loose connective tissue and along the fascial planes. They also concluded that the toxins of the Clostridium welchii inhibited the accumulation and phagocytic action of leucocytes and other phagocytic cells.

As gas and edema accumulate in spaces confined by aponeurosis and stretched in elastic skin, a great increase of pressure occurs in the tissues which is sufficient to produce further necrosis of muscles and compression of the lymphatics, veins, and arteries even as large as the femoral. This opens the malignant phase of the infection, and the successive stages of muscle disintegration and bacterial invasion follow one another with great rapidity involving not only a single muscle but a whole group and often an entire limb. The muscles, at first hemorrhagic and friable, contract and soon exude a watery, blood stained and often brown, foul discharge containing bubbles of gas. The infiltration of the muscles and the intermuscular planes extends well above the area in which

it is palpable. The accumulative effect of this vicious circle may cause the infection to be well advanced in 2 hours, and has been known to produce death from massive gas gangrene of an entire limb in less than 30 hours.

The anatomical picture of special gas gangrene infections may be so typical that conclusions as to the causal organisms may be possible. In the usual case of clostridial myositis caused by the Clostridium welchii, the lesion occurs most frequently in the thigh, particularly in the upper anterior aspect, as an emphysematous gangrene that spreads, in some cases very extensively, from the initial local focus. The wound is very dirty and exudes a thin, dark, evil smelling discharge containing bubbles of gas. The edges of the wound are dark and often black and the surrounding skin is tense, swollen, and pallid, but gradually assumes a yellowish blue or green color, and still later presents areas of necrosis. In clostridial myositis caused by the Clostridium oedematiens alone or in combination with other bacteria, the most characteristic feature is the absence of gas with widespread and rapidly progressive gelatinous edema, immediate and severe general intoxication, and a time lag of 48 hours or more before the appearance of gangrene. The cellular spaces and subcutaneous tissues are distended by a clear gelatinous edema and the muscles are dark red or raspberry in color.

SYMPTOMS AND SIGNS

The incubation period between the injury and the onset of gas gangrene varies between a few hours and 4 or more days. Lazarus and Cruickshank stated that while the usual incubation period varied from 1 to 6 or 7 days, the average being 3 days, it has been known to be as short as a few hours after operation and as long as 10 years after inoculation. In the experience of Neel and Cole in the Pacific area, it varied from 1½ to 5 days, the average being 2.35 days. MacLennan (108) reported an average incubation period of 23 hours for the Clostridium welchii, 48 hours or more for the Clostridium oedematiens (with an average of 5½days), and 3 days for the Clostridium septique. Although the incubation period may be as short as 6 hours after wounding, the chief clinical manifestations usually develop on the second day.

Pain is nearly always the earliest symptom (30, 54, 167, 21, 108). Although it may be due in part to the effects of injury, it is caused principally by the rapid infiltration of the tissues by fluid and gas. In some instances, it has been described at first as a sensation of heaviness or tension and later as a burning, but rarely a throbbing, pain. In virulent cases the initial symptom has usually been spontaneous pain or a sudden increase in the intensity of pre-existing pain, which appeared within 18 to 24 hours after the injury and which was followed shortly by a distinct and rapidly developing distention of the traumatized tissues. Later, the pain may disappear, and in the overwhelming toxemic forms complete absence of pain may be characteristic.

Rapid pulse. An alarming rapidity and feebleness of the pulse soon follows the onset of pain which is out of all proportion to the temperature (22, 30, 54). This may become increasingly apparent and progress to circulatory collapse which may be abrupt, progressive, and severe. As the pulse rate becomes increasingly rapid, the amplitude becomes steadily smaller. Early, the blood pressure has been described as slightly elevated (167), but later it may become significantly low (108).

Temperature. The degree of fever varies considerably but frequently it is less than 101° F. It is not a reliable index of the severity and extent of the infectious process, but it may indicate the prognosis, for a low temperature with rapid pulse suggests a grave outlook. In civilian practice this is not always true, since we have seen severe proved cases with a temperature of 105° F. or greater. In the mildest type of clostridial infection, clostridial cellulitis, there often is considerable rise in the temperature but the pulse rate shows a corresponding increase.

General appearance. Early in the course of the disease the patient may develop a peculiar grayish pallor, listlessness, weakness, profuse sweating, prostration, breathlessness, and dilated pupils. The usual malar flush associated with pyogenic infections is replaced by a striking pallor (54) and an extremely worn or strained expression of the face (99). The pallor may be succeeded by a yellowish or icteric tint of the skin and sclerae. MacLennan (107) has emphasized that the profound shock and toxemia developing in gas gangrene are relatively uninfluenced by transfusions of blood.

Mental state. This is one of apathy and indifference, the patient being quite conscious but usually unaware of the seriousness of his condition. The more common central nervous symptom manifestations may be divided into those of hypoirritability and hyperirritability. The former are more common with the wet type of gas gangrene while the latter are more frequently seen in the crepitant form (30). Stupor, delirium, and coma may occur late.

Gastrointestinal symptoms. Anorexia is a fairly constant finding and vomiting is not an uncom-

mon symptom. The tongue very quickly becomes dry and coated.

Appearance of the local lesion. The skin overlying the lesion is at first white and tense. There is usually an irritating, dirty, brownish, watery discharge from the wound with a peculiar foul odor. As the swelling increases, the overlying skin becomes dusky and bronzed or khaki-colored in appearance (54). If further discoloration occurs, vesicles filled with dark red fluid appear on the cutaneous surface and later coalesce as the lymphatics and venous channels become blocked. The changes in color of the skin appear earlier in the more superficial and confined infections than in the deep, highly invasive types. The distal portion of the limb becomes edematous, engorged, discolored, cold, and finally gangrenous. If the patient lives long enough, sloughing may occur. The area of wet gangrene of the skin is always much less than that of the underlying muscle. The edema that occurs in gas gangrene is an integral part of the picture. With certain of the bacteria, such as the Clostridium oedematiens, the swelling is extreme and causes the skin to become tense and marblelike in appearance. The appearance of the muscles with their grayish or black sloughing surface is a striking feature. They may be so swollen that they herniate out of the wounds (55). The necrotic muscle does not contract or bleed when cut, and usually presents a darkened color with few gas bubbles in the wound and in the intermuscular septa.

In discussing battle casualties in a South Pacific Evacuation Hospital, Potts pointed out that bubbling of small amounts of gas from an infected wound does not necessarily mean gas gangrene in the ordinarily accepted sense of the term, but a less virulent localized area of myositis in the absence of the well recognized clinical picture. In the cases of clostridial myositis seen by Ross and Ryan in the Owen Stanley and Buna-Gona Campaign, wide variation in clinical types was seen, ranging from the classic fulminating infection with the associated general signs to a local abscess around a retained missile. These latter cases were not gas gangrene, but localized areas of clostridial myositis.

Laboratory examinations. In many instances a marked reduction in the number of red corpuscles occurs with counts ranging between 1 and 2 million cells per cubic millimeter. The low red blood counts and hemoglobin levels as low as from 30 to 40 per cent are due to the hemolytic anemia and are probably the most striking laboratory findings. The leucocyte count usually does not exceed 12,000 or 15,000 cells per cubic millimeter, but in civilian practice it may occasionally be quite high. In the experience of Nikolskaya severe infections produced by the Clostridium welchii in association with the Clostridium oedematiens were often associated with a leucopenia, a definite lymphopenia, but rarely a leucocytosis.

According to Trueta, there may be an immediate deterioration of the liver function with consequent acidosis, which was first noticed by Sir Almroth Wright during the first World War and confirmed by Marquid, Clogne, and Didier in France. How far the acidosis contributes to a fatal issue is not known, but the prognosis is related to its intensity.

Positive blood cultures are rarely found (26, 54) but may occur in the initial stages of the fulminating Clostridium welchii toxemia described by Trueta. In infections produced by the Clostridium oedematiens, rises in hemoglobin levels to as much as 130 per cent have been reported if the edema became extensive and much oozing occurred.

DIAGNOSIS

It must be emphasized that this disease is a clinical concept which has usually been recognized by the clinical appearance of the patient and his lesion in its obvious, far advanced, and often irreversible stages. Continued pain at the site of a wound containing devitalized muscle, a rapid and easily compressible pulse, varying degrees of fever, toxemia in association with spreading edema, a thin brown water malodorous discharge, crepitation, herniation of discolored muscle which does not bleed or contract, and typical discoloration of the skin in the region of the wound are relatively late symptoms and signs that strongly suggest the nature of the lesion, even to the novice. Repeated questioning and close observation of wounded patients unquestionably are of value, and the old principle of promptly inspecting the wound in the presence of unexplained fever or pain has been particularly valuable in the earlier recognition of the process. Infiltrating gas may be detected early by the experienced observer through auscultatory percussion, but usually the presence of casts, splints, or large dressings obscures the wound and makes diagnosis difficult and the interpretation of local signs indirect.

Considerable investigative work has been carried out to facilitate earlier diagnosis, principally through the development of methods for the rapid identification of the clostridia welchii and oedematiens, and other anaerobes associated with gangrene. Methods have been developed and adapted to clinical use by Butler (23), using the demonstration of stained capsules for the Clostridium

welchii obtained from smears, cultures, or tissue; by Altemeier (8), using a modification of the stormy fermentation of milk by the Clostridium welchii; by Nagler; Crook; Hayward; Weed and Minton, using the Nagler reaction for the Clostridium welchii; and by Gordon and McCleod, using heated blood agar plates containing benzidrine for the rapid identification of the Clostridium oedematiens. Reed and Orr (148) also collected a series of diagnostic biochemical reactions which were generally sufficient to differentiate the various species within 24 hours. While these various tests aid considerably in early diagnosis, they all have definite limitations. They do not distinguish the virulent and toxigenic strains from the nonpathogenic ones (104) and it must be kept in mind that these anaerobes have been frequently isolated from wounds not affected with gas gangrene.

Serial roentgenograms taken for gas in the soft tissues have been of practical value in the detection of early or incipient gas gangrene, permitting a positive diagnosis 24 or more hours earlier than possible by the clinical findings alone (10, 13, 167). Films taken at intervals of from 2 to 12 hours may aid in the differentiation of gas due to the clostridia from that due to mechanical causes. If the gas increases in amount or presents a linear spread in the muscle planes, a diagnosis of gas gangrene can be made.

It must be kept in mind that valuable time may be lost in awaiting results of various diagnostic tests during which irreversible changes may occur in the tissues. For this reason it has been more practical in our experience to explore surgically, and without delay, any wound in which the presence of clostridial myositis is suspected. This plan permits earlier radical surgery when necessary, and thereby the most effective method of control of the process.

DIFFERENTIAL DIAGNOSIS

Anaerobic cellulitis, streptococcal myositis, and hemolytic streptococcal gangrene must be considered in the differential diagnosis of gas gangrene. Of lesser importance are traumatic emphysema, magnesiogenous pneumagranuloma, staphylococcal acute infectious gangrene, and gangrene caused by the accidental injection of some foreign agent.

Anaerobic or clostridial cellulitis is a crepitant septic process of the epifascial, retroperitoneal, or other connective tissues which usually have been devitalized by trauma. There is usually no extensive invasion of living muscle as in true gas gangrene. It is most commonly seen in extensive lacerations of soft tissues other than muscle, the anaerobes multiplying freely in necrotic debris. The incubation period of anaerobic cellulitis is usually 3 or 4 days and the onset is more gradual than that of true gas gangrene. Systemic effects may be slight unless the wound is also very septic, and this relative mildness of the general reaction is helpful in distinguishing between it and true gas gangrene. However, anaerobic or clostridial cellulitis is not a condition to be regarded lightly. The spread of infection in the tissue spaces may be rapid and extensive and necessitate radical surgical drainage even within a few hours.

Streptococcal myositis. In this condition there is a massive infection of muscle, together with discoloration, edema, serous exudate, gas formation, local pain, and generalized toxemia. Neglected cases may progress to a true gangrene of muscle. The chief points of differentation between it and clostridial myositis are: (1) its more pronounced and extensive cutaneous erythema; (2) its involvement of muscle which, although edematous and discolored, is still alive and reactive to stimuli; (3) its different odor; and (4) the microscopic appearance of a muscle smear stained by Gram's method which reveals no gram-positive bacilli but vast numbers of streptococci among masses of pus cells.

Hemolytic streptococcal gangrene occasionally follows some relatively minor operative procedure or injury. The lesion is essentially an epifascial, spreading subcutaneous gangrene with thrombosis of the nutrient vessels and resultant slough of the overlying skin. It usually develops in the extremities, although the perineum, face, and other parts of the body may be involved. It is characterized by the onset of pain and marked swelling at the site of the wound, chills, elevation of the temperature to from 101° to 104°F., rapid pulse, toxemia, prostration, and a rapidly spreading painful cellulitis which undergoes bullous formation and a peculiar patchy and extending necrosis. Hemolytic streptococci are found in the subcutaneous gangrene and bullae, often in pure culture.

Acute infectious staphylococcal gangrene may occasionally simulate gas gangrene. Morrison reported such a case in a 5½ year old boy who developed a rapidly spreading cellulitis with pain, swelling, brawny induration, patchy discoloration of the skin, and elevation of temperature to 105°F. 3 days after injury. No organism other than the Staphylococcus aureus was demonstrated on aerobic and anaerobic culture of the pus obtained by multiple incisions in the involved tissues.

Crepitation of tissues not produced by bacteria. Cases in which air has been sucked into tissues by penetrating or perforating missiles have been confused with true gas gangrene in some instances.

Clinical examination of these patients who do not show the signs of severe toxemia reveals palpable crepitation in the tissues, but roentgenological examinations usually show that collections of air lie along the course of the wound rather than in the planes of the tissue.

Rubenstein, Tabershaw, and Daniels reported 3 cases with subcutaneous crepitant tumor masses about lacerations of the hand in patients who had handled an alloy containing 90 per cent of finely powdered magnesium.

An extremely rare condition which may be confused with gas gangrene is that caused by the accidental injection of benzene. Schreus reported on a series of 15 patients who developed crepitant necrosis of muscle a few hours after injection into the pectoralis muscle of material thought to be typhoid vaccine but later proved to be benzene. No bacteria were found in the exudate.

TREATMENT

Prophylaxis. Early and adequate surgery is still the most effective means of preventing gas gangrene since it not only eliminates the conditions necessary for the propogation of the bacteria but also removes most of the contaminating bacteria (3, 13, 21, 25, 29, 93, 135, 176). Adequate surgery implies early meticulous excision of all dead and devitalized tissues, removal of dirt, clothing, and other foreign material from the wound, preservation of the blood supply, relief of tension, and sufficient drainage when indicated. In this instance as always, it must be remembered that débridement has replaced the use of antiseptics in the prevention of wound infections (2). The use of postoperative immobilization and the avoidance of tension, constricting or malfitting casts and dressings which might produce ischemia and further devitalization of tissue are also integral parts of prophylactic surgical treatment. Any "packing" of open wounds must be done loosely, as tight packing may result in devitalization of tissues from pressure and inadequate drainage.

Although there is considerable evidence that the prophylactic administration of gas gangrene antitoxin is of little practical value in the prevention of clinical gas gangrene, it has been given almost routinely at the time of injury (3, 41, 48, 51, 62, 63, 83, 93, 110, 121, 171, 176). English surgeons (49), however, have strongly advocated the prophylactic administration of antitoxin to injured patients in whom there is any reason to anticipate gas gangrene as a likely complication. In 1944 the preparations recommended by the British contained 22,500 international units of polyvalent antitoxin, including 9,000 units of Clostridium welchii antitoxin, 4,500 units of Clostridium septique antitoxin, and 9,000 units of Clostridium oedematiens antitoxin in each ampule. The surgeons stated that clinical judgment of the local and general condition should determine whether the minimum prophylactic dose is likely to suffice or if the dose should be repeated or increased. Hall (65, 66) also stated that there was no reason to doubt the prophylactic value of 7 American gas gangrene antitoxins against the anaerobic infections for which they were intended. He believed that when prompt adequate surgery is possible, gas gangrene may be prevented by this method alone and that the prophylactic use of serum may augment the effectiveness of both early and delayed surgery. He reported that 6 of the commercial antitoxins available were bivalent, containing Clostridium welchii and Clostridium septicum antitoxins only. Those who question the effectiveness of antitoxin as a prophylactic agent state that gas gangrene is not too well defined as a clinical disease which has a multiple etiology. Since a large variety of gas forming anaerobic bacteria has been identified with this infection, either in pure or mixed culture, it seems rational to use the pentavalent antitoxin rather than any of the lesser valent antitoxins. It seems well established that the prophylactic use of antitoxin can in no way take the place of adequate surgery.

At first chemotherapy appeared to be effective in the prevention of gas gangrene, but subsequent experience has shown the great limitations of each of the available agents. Penicillin has been by far the most effective (9, 10, 55) and streptomycin the least. Cutler and Sandusky reported 5 cases treated with penicillin immediately following primary débridement, in which gas gangrene developed. They concluded that proper surgical débridement is the major factor in both the prophylaxis and therapeusis of this infection. Similar experiences were reported by Patterson, Keating, and Clegg and by Conway.

In a series of investigations on experimental gas gangrene in guinea pigs produced by the Clostridium welchii of standardized virulence, Altemeier and Furste (10) were unable to demonstrate any prophylactic effect of penicillin when a dose of 2,000 units per kilogram per 24 hours was given in divided doses every 3 hours and continued for 4 days. This dose corresponded to one of approximately 17,500 units every 3 hours for an adult male. When the dose was increased to 8,000 units per kilogram per 24 hours, corresponding to an adult daily dose of 70,000 units every 3 hours, the survival time was definitely lengthened and 16 per cent of the animals survived. When the dose was

further increased to 32,000 units per kilogram per 24 hours, equivalent to an adult dose of 280,000 units every 3 hours, 64 per cent of the animals survived. A further increase to 96,000 units, equivalent to approximately an adult dose of 1,000,000 units every 3 hours resulted in survival of 90 per cent of the animals during the period of treatment. Since the wounds were not débrided, the infections became worse and finally terminated in death after discontinuation of therapy, which indicated the bacteriostatic nature of penicillin. In a similar study, Altemeier and Culbertson (9) were unable to demonstrate any significant protective value of streptomycin in experimental gas gangrene, even when daily doses corresponding to 9 gm. per 24 hours in an adult man were used.

These studies indicate that penicillin administered parenterally in large doses is the chemotherapeutic agent of choice to be used in conjunction with adequate surgery for the prevention of gas gangrene. They also suggest that massive doses of penicillin can prolong the period of effective surgery short of amputation.

Early experience with the sulfonamides indicated that their use topically and systemically was of definite prophylactic value (89, 141), but later observations on civilian wounds by the Subcommittee on Infected Wounds and Burns of the National Research Council clearly indicated the limitations of sulfonamide therapy and its inability to replace adequate surgery. Experimentally, the sulfonamides have not been as effective as penicillin.

Considerable interest has become manifest recently in the possibility of producing active immunity against gas gangrene by toxoid immunization similar to that produced against tetanus. New methods of producing more potent toxoids have been developed from many of the clostridia associated with this infection. Preliminary results of immunization studies which have been started in experimental animals with these improved toxoids (153) have been encouraging.

Therapeusis. Most surgeons agree that early and adequate surgery is the most effective means of treating gas gangrene (6, 13, 29, 35, 60, 70, 84, 87, 109, 137, 171, 174). If the diagnosis is made at an early stage while the gangrene is more or less localized and incipient, radical decompression of the involved fascial compartments by free longitudinal incisions and excision of the infected muscle usually will result in the arrest of the process and saving of the extremity. Local excision of a single muscle or group of muscles is practiced in preference to amputation whenever possible in an attempt to conserve a functional extremity. If the diagnosis is made late when the process is extensive and has caused irreversible gangrenous changes implying permanent loss of function of the limb, open amputation of the guillotine type or some modification becomes necessary. At the moment, it is inconceivable that any type of serotherapy or chemotherapy can replace good surgery in the treatment of established gas gangrene.

There is considerable confusion regarding the value of serotherapy in the treatment of established gas gangrene. There is some evidence that the use of antitoxin in conjunction with adequate surgery aids in the control of the associated toxemia and until more conclusive evidence is produced to contraindicate its use, antitoxin should be given in adequate dosage every 4, 6, or more hours (22, 40, 71, 76, 91, 97, 101, 120, 137, 167, 178). Its effectiveness is probably decreased as the interval increases between the development of the disease and the initial dose. The serum should be given intravenously if possible, which is sometimes a difficult task because of the accompanying secondary shock. The British investigators (105, 110, 176) have been especially enthusiastic about antitoxin, and have emphasized the necessity of giving large doses frequently. They recommend the intravenous injection of a therapeutic dose consisting of 27,000 units of Clostridium welchii antitoxin, 13,500 units of Clostridium septique antitoxin, and 27,000 units of Clostridium oedematiens antitoxin at the earliest sign of gas gangrene (49). The essential objective has been the prevention of death from toxemia by the persistent repetition of the therapeutic dose at intervals of 4 or 6 hours until surgery and chemotherapy can control the local condition. Other recent reports indicate less confidence in gas gangrene antitoxin. Conway concluded that antitoxin given in therapeutic amounts to 8 battle casualties with Clostridium welchii infections produced no obvious effect on the toxemia, and Odom, who reviewed 445 cases with clostridial gangrene infections in the European Theater, reported that gas gangrene antitoxin used in large doses seemed to be of very little value.

Penicillin appears to be the most effective chemotherapeutic agent available at the present time (38, 67, 71, 78, 84, 87, 93, 95, 101, 110, 111, 120, 172) for established gas gangrene, being far superior to the sulfonamides and streptomycin. Clinical investigations indicate that parenteral administration of penicillin used in conjunction with surgery gives encouraging results, but only when injected in relatively large doses of from 200,000 to 400,000 units (171) and 800,000 units

(120) per day. In their studies of experimental gas gangrene, Altemeier and Furste (10) found that average doses had no measurable effect, but that large doses, corresponding to 8,000,000 or more units per day in an adult man, had a definite therapeutic effect. Without surgery, however, discontinuation of penicillin was followed by spread of the lesion and ultimate death. These experiments indicated that penicillin, when used in large doses, is a valuable adjunct to adequate surgery in the treatment of established gas gangrene because it limited the spread of the lesion, prolonged the period during which surgical decompression and excision of involved muscles could be done successfully, and reduced the mortality. A dose of 1,000,000 units or more every 3 hours is suggested for clinical use in the management of severe established infections. Apparently such large doses may be given without toxic effect. Keefer and Anderson pointed out that the maximum dose of penicillin that can be given to man has not been determined as yet, and that doses as large as 100,000,000 units a day have been given without ill effect (85).

On the other hand, Odom and Conway concluded that penicillin in much smaller doses was of little or no value, and the former believed that its sole value lay in controlling secondary infection.

Early experiences with the sulfonamides led to the recommendation of their use in the treatment of gas gangrene (13, 33, 39, 64, 76, 77, 107, 137, 160), but the recent trend has been away from the use of sulfonamides for gas gangrene itself (171). Jeffrey (79) found no evidence that sulfanilamide, alone and without operation, saved any patient from true gas gangrene. Langley and Winkelstein, who studied 96 cases treated at an evacuation hospital in Northern France during 1944, believed that sulfonamides had little or no effect on the course of gas gangrene, and Conway concluded that there was no evidence that sulfadiazine given in adequate amounts produced any significant change in the general condition of patients.

A variety of preparations have been used for topical application on surgical wounds resulting from the treatment of gas gangrene. The use of activated zinc peroxide as a watery suspension (120) or ointment (6, 32, 64, 75, 101, 120, 150) seems to be the treatment of choice. Effective use, however, depends primarily upon correct application at intervals of from 1 to 2 days with intimate contact of the tissues with the zinc peroxide preparation, adequate hydration produced by a layer of wet absorbent cotton, prevention of the escape of liberated oxygen and moisture by a layer of ointment gauze, and a mild compression dressing.

The value of roentgen irradiation as a method of therapy in true gas gangrene is still uncertain. Kelly has been its most enthusiastic proponent and in his opinion the results of its use have far surpassed those obtained with serum, débridement, and amputation. He has been inclined to regard roentgen therapy as a specific in gas gangrene, recovery following its use in all cases if it was employed during the first 24 hours. McMilan was equally enthusiastic; he reported a mortality of 14.9 per cent among the 416 cases in which roentgen therapy had been used. Cantril (27,28) recently deplored the lack of appreciation by physicians of the value of treatment of this type of infection with the roentgen ray. He believed that débridement or other surgical procedures in the acute phase of an already established gas bacillus infection was not indicated when roentgen therapy was available. In view of the fact that serum and surgery were employed in some of the cases, it is difficult to say whether the recovery of 4 patients was due to roentgen therapy or to serum therapy and surgery, and the same difficulty applies to the reports of Faust and Turner.

Unfortunately these results have not been substantiated by other clinical investigators, and attempts to reproduce them in animal experiments have failed. Cubbins, Callahan and Scuderi were of the opinion that the roentgen irradiation of gas bacillus infection had little, if any, value and they saw no reason for considering it as a method of treatment. In 8 cases of proved gas infection which were treated by roentgen irradiation and without surgery or antitoxin, there were 8 deaths. Cozen (37, 38) also thought that it is unwise to place complete reliance on roentgen therapy for gas gangrene. In his 8 cases which were treated without operation or antitoxin but with roentgen irradiation, there were 8 deaths. Coleman and Bennett, using roentgen therapy alone in 14 cases, had 4 recoveries and 10 deaths. In experimentally produced gas gangrene, Caldwell and Sewell, Dowdy, and Vincent, as well as Kelly and his associates, have been unable to demonstrate any measurable beneficial effect from roentgen therapy.

The general supportive measures of value in the management of gas gangrene include frequent or daily blood transfusions, maintenance of the fluid and electrolyte balance (6, 13, 82), adequate immobilization of the infected and injured parts (6, 167), oxygen therapy, and the relief of pain. Frequent blood transfusions help to correct the profound anemia with which this condition is frequently associated (6, 13, 32, 171). Conway found that the frequent transfusions of whole blood were

the mainstay of postoperative management. Plasma has usually been reserved for the correction of persistent hemoconcentration in selected cases of the "wet" types of clostridial infection.

From an analysis of available information, the effective methods of treatment for established clostridial myositis or true gas gangrene may be summarized as follows:

1. Radical surgery as soon after diagnosis as possible, consisting of multiple incisions for decompression and drainage of the fascial compartments, excision of the involved muscles, or open amputation when necessary, followed by adequate immobilization of the affected part.
2. Administration of polyvalent gas gangrene antitoxin before and after surgery—50,000 units every 4 or 6 hours as indicated to aid in the control of the toxemia.
3. The injection of penicillin parenterally in very large doses up to 1,000,000 or more units every 3 hours before and after surgery to aid in the control of the infection. After its obvious control, the dose of penicillin may be gradually reduced.
4. Complete bacteriological diagnosis.
5. Sulfadiazine or streptomycin may be used for the control of secondary infection if indicated.
6. Adequate supportive therapy, including frequent transfusions of whole blood, relief of pain, maintenance of the fluid and electrolyte balance, and control of acidosis.
7. The topical use of zinc peroxide ointment on wound surfaces after radical surgery.
8. Secondary operative procedures to facilitate healing of the wound or function of the extremity as indicated.

SUMMARY

A survey of the literature reveals that gas gangrene is a very old disease of multiple bacterial etiology and variable clinical picture which occurs as a spectacular and destructive complication in an average of 1.76 per cent of all contaminated wounds of violence. Recent studies have increased our knowledge regarding the predisposing and exciting etiological factors of this disease, but the precipitating factor that sets off the infection and explains the discrepancy between the low incidence of infection and high incidence of clostridial contamination in similar wounds is still unknown. The steadily increasing reservoir of information which is being accumulated regarding the characteristics, toxins, and virulence of the various clostridia is contributing to a better understanding of the pathogenesis of this disease. Recent evidence suggests that the profound toxemia associated with this condition is complex, being caused not only by the specific toxins and enzymes produced by the bacteria, but also by nonspecific toxin products arising from the degenerating tissue in the area of infection. It has been relatively easy to protect animals from the injection of one or more minimum lethal doses of toxin by the administration of antitoxin or by immunization with toxoid. On the other hand, the protection afforded by antitoxin or toxoid has been only partial against one or more minimum lethal doses of virulent bacteria.

The various clinical and pathological pictures associated with this condition in its advanced stages have been well established, but considerable difficulty is still experienced in the early recognition of the process. The intelligent use of serial roentgenograms has been of value but better methods of early diagnosis are still needed. Numerous diagnostic tests have been devised recently to facilitate an early and positive diagnosis. Although some of these are of value, definite limitations and even danger may attend their clinical use.

Early and adequate surgery is still the best method of treatment for either the prevention or control of gas gangrene. Chemotherapy has been shown to be a valuable adjunct to surgery, and penicillin in massive doses appears to be the agent of choice. The effectiveness of serotherapy both prophylactically and therapeutically is still disputed, but the evidence indicates that the early administration of the polyvalent type aids in the control of the toxemia when used in conjunction with the necessary surgery.

The preliminary results of investigations with toxoid immunization of experimental animals are encouraging and suggest that effective prevention of this condition by the use of toxoid is a definite possibility.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Kazanjian, V. H., and Webster, R. C.: The Treatment of Extensive Losses of the Scalp. *Plast. Reconstr. Surg.*, 1946, 1: 360.

Extensive loss of the scalp has always been a difficult surgical problem. Step by step, through surgical history, the accepted methods of treatment used today have developed.

A brief but thorough review of the anatomy of the scalp is given. The anatomical features have a bearing on the results of trauma, on the treatment of the loss and, at times, on the etiology of that loss.

Large losses of the scalp may be caused by (1) burns—thermal agents, chemical agents, electricity, or radiation; (2) impacts of sharp or blunt objects; (3) infection; (4) scalping—by paws of animals or by humans; (5) industrial accidents—entangling of hair in rapidly moving machinery.

A brief résumé of treatment through the ages is given, and the general care of patients is duscussed.

Seven case reports are presented to illustrate the treatment of scalp loss in various circumstances.

Small defects may be closed by extensive undermining in the subaponeurotic area, with relaxing or crosshatching incisions from below through the galea but not through the skin or superficial fascia.

In extensive losses of the scalp, every effort should be made to close the wound as soon as possible by skin grafting. If any hair-bearing tissue remains, it can be utilized later as flaps to areas best suited for cosmetic purposes.

The periosteum is vascular enough to take skin grafts. Periosteal flaps and tags should be sutured into position and grafts placed upon them. Split-thickness grafts cut with the dermatome are most suitable. If the entire scalp cannot be covered at once, the anterior portion should have priority since it is here that the worst deformities (ectropions) occur.

In the second case reported, an attempt was made to reapply the completely detached scalp. Only about 8 per cent of the replaced scalp survived.

If periosteum has been lost, a vascular bed for grafting must be obtained. In the author's hands, chiseling away the outer cortex until multiple bleeding points showed themselves has been simplest and most satisfactory. In a week or slightly more, granulations well able to sustain a split-thickness graft are present.

Inadequate early treatment results in two common, late complications. Late contracture may result in severe ectropion of the upper eyelids. Excision of the scar and replacement with a dermatome graft is the treatment. The second late complication is the breaking down of scar epithelium with occasional carcinomatous degeneration. After removal of the scar or malignancy, or both, it may be necessary to use a tubed pedicle flap for closure.

EARL H. KLABUNDE, M.D.

Wass, S. H.: The Odontomes and Other Affections of the Jaws: Their Pathology, Diagnosis and Treatment. *Guy's Hosp. Rep.*, Lond., 1946, 95: 21.

Among the odontomes (cysts, tumors, and malformations of the jaws arising from tooth germ) and the dental and dentigerous cysts, the adamantinomas or multilocular cysts are the more important ones, and are discussed as to pathology and clinical picture. Among other lesions, the osteoclastoma, osteitis fibrosa, osteomyelitis, and actinomycosis are discussed and illustrated by roentgenographs and photographs of pathological specimens, and roentgenographs of lesions of differential diagnostic importance (carcinoma) are presented.

In his discussion of treatment, the author stresses the necessity of complete removal even of the benign, noninflammatory lesions (except fibro-osseous tumors, in which cases complete removal is not essential) if recurrence is to be avoided.

The malignant lesions comprise the adamantinomas, epitheliomas of the alveolar process, metastatic carcinomas, and sarcomas. The author does not discuss the latter 2 lesions in detail. Epitheliomas respond mostly to irradiation. Adamantinomas are nonradiosensitive and require radical excision, followed by bone grafting, which may be a formidable operation in the aged. Curettement may be deemed preferable in some of these cases although it is inevitably followed by recurrence.

Radical operation, likewise, is the author's choice for osteomyelitis of the jaw, and neither bone drilling nor penicillin will prevent the spread of the disease He states that even in late cases with much soft tissue swelling, delay is ill advised, and bold approach to the bone and radical and extensive excision is needed.

The author then elaborates on his experiences as to details of treatment. For malignancy of the upper jaw the classical excision of the maxilla is unsurpassed, and for cysts and benign tumors the intraoral approach is satisfactory. On the mandible, however, most all of the more extensive lesions are better approached from the outside. Such an approach gives better exposure and dependent drainage, and avoids severance of the mucosa. The author's discussion on the technique of approach should be read in the original.

Wass is impressed by the efficacy of orally administered penicillin in controlling intraoral flora and

postoperative infection when oral mucosa had been opened. Penicillin, given systemically, will not cure osteomyelitis of the jaws unless all diseased bone has been removed surgically. Penicillin can be used to good advantage preoperatively and postoperatively in cases of oral surgery.

An incision behind the ramus ascendens and below the ramus horizontalis of the mandible gives good cosmetic results if it heals by primary intention. There is danger of injury to a branch of the facial nerve and to the inferior dental nerve, the one resulting in objective, the other in subjective disturbances. Bone defects of the mandible usually reconstruct themselves rapidly and completely.

HEINRICH LAMM, M.D.

EYE

Adler, F. H.: Physiological Factors in the Differential Diagnosis of Paralysis of the Superior Rectus and Superior Oblique Muscles. *Arch. Ophth.*, Chic., 1946, 36: 661.

The differential diagnosis between paralysis of the superior rectus and the superior oblique muscle of the eye is discussed. According to Bielschowsky, most vertical anomalies are due to paralysis of the superior oblique muscle, but according to Duane they are due to paralysis of the superior rectus muscle. Adler attributes most primary or congenital vertical motor paralyses to paralysis of the superior oblique muscle.

The differential diagnosis between paralysis of the superior oblique muscle of one side and paralysis of the superior rectus muscle of the opposite side can be made by the position of the head. Head tilt, the most characteristic sign of paralysis of the superior oblique muscle, is attributed to the fact that contraction of this muscle in the primary position results in 56 per cent of the movement being intorsion, so that in cases of paralysis, extorsion results, which is compensable only by tilting the head in a position which again brings the two vertical meridians into parallelism, that is, tilting of the head to the opposite shoulder.

In paralysis of the superior rectus muscle the tilting is only slight because the superior rectus in the primary position exerts only 25 per cent of its pull as intorsion.

In all cases, the head is tilted toward the side opposite the paralyzed eye, e.g., in right hypertropia (paralysis of either the right superior oblique or of the left superior rectus), the head is markedly tilted toward the left shoulder if the right superior oblique is paralyzed, and is only slightly tilted toward the right shoulder if the left superior rectus is paralyzed. Moreover, if the patient's head is tilted by the examiner to the shoulder of the same side as the paralyzed eye, this eye will make an upward movement if the superior oblique muscle is paralyzed, and it either will not move at all or will move only slightly downward if the superior rectus muscle is paralyzed.

JOSHUA ZUCKERMAN, M.D.

Lloyd, I.: A Survey of the Results of Lacrimal Stricturotomy. *Brit. J. Ophth.*, 1947, 31: 51.

The author analyzes the results and the causes of failure in 33 cases of lacrimal stricturotomy. The advantages of the French technique compared with those of other methods of treatment of lacrimal obstructions are discussed.

The French method consists of opening the lower canaliculus with a Weber knife for 3 mm. and dilating the canaliculus with a number 3 sound. The stricturotomy knife is then passed down into the sac and engaged in the neck of the duct. It is held vertically and the edge rotated forward through an angle of 45 degrees so that it faces forward in order to prevent cutting of the lower part of the canaliculus where it opens into the sac. Gum-elastic sounds from number 11 to 14 are passed into the duct and the largest one is left in place for 10 minutes. Dilatation is done at intervals of from 4 to 6 weeks for a period of several months.

Symptomatic relief was obtained in 76 per cent and complete cure in 52 per cent of this series of 33 stricturotomies. The French claim cure in 100 per cent of the cases with no bony obstruction and in 70 per cent of those with such obstruction. Seven failures were attributed to various causes such as impassable stricture, very tight strictures, infection with mucopurulent regurgitation, and burn scars.

The operation of stricturotomy can be performed in the outpatient clinic. Although the presence of a stricture at the junction of the lacrimal sac and the nasolacrimal duct has been denied, roentgenologic findings and open operation have revealed that this abnormality exists in many cases of epiphora.

JOSHUA ZUCKERMAN, M.D.

Stallard, H. B.: The Intraocular Foreign Body. A Series of 72 Cases in the B.L.A. *Brit. J. Ophth.*, 1947, 31: 12.

The author reports a series of 72 cases of retained intraocular foreign body. He discusses the methods of x-ray localization, and the various types of giant electromagnets used for removal of foreign bodies. Speed is important when daily convoys deliver several hundred wounded at a time. The average time for each case was 3 minutes for suturing a limbal ring into place, 10 minutes for the x-ray examination, and from 7 to 12 minutes for the extraction of the foriegn body by the scleral route.

In most cases the scleral route was indicated for extraction of the foreign body. This route is simpler and less traumatizing than the anterior route. The danger of vitreous loss is negligible. No vitreous was lost in any of the cases in this series. Retinal detachment, generally considered a complication of the scleral route, does not occur if diathermy is used around the incision in the sclera.

Of this series of foreign bodies, 69.3 per cent were extracted; 51.3 per cent by the scleral route and 18 per cent by the anterior route.

To extract war missiles of feebly magnetic alloys, the terminal of a very powerful electromagnet must

be placed between the lips of the scleral incision and brought as close as possible to the foreign body.

JOSHUA ZUCKERMAN, M.D.

Mann, I., Pirie, A., and Pullinger, B. D.: Lewisite Lesions of Rabbits' Eyes. *Am. J. Ophth.*, 1946, 29: 1215.

In this article, the authors contrast lewisite induced lesions with the results of mustard gas application. The work was carried out experimentally on rabbits' eyes. The effects of lewisite in contrast to those of mustard gas show that:

1. The action is immediate and painful.
2. There is an immediate strong miotic action.
3. Perforation and loss of an eye are caused with relatively small doses (0.001 cc.); perforation may occur within a few days without vascularization, or later after the entry of blood vessels.
4. Vascularization is independent of the site of the primary lesion; it occurs when a sufficient dose of the lewisite reaches either the cornea or the limbus.
5. All lesions run a definite course to recovery or destruction; not all vascular lesions perforate; there are no relapses and no recurrent hemorrhages.
6. Cholesterin and other lipoid scars do not occur, and there is no late breakdown due to them. The end result of a nonperforating severe lesion is a dense fibrous scarring with pigment proliferation on the corneal and conjunctival epithelium.
7. Edema of the lids and conjunctiva is immediate and severe; edema of the cornea is extreme with all but the smallest doses.
8. Involvement of the iris and ciliary body is early and severe, followed by gradual depigmentation and shrinkage of the iris stroma.
9. The corneal vessels do not show the characteristic varicosities of vessels subjected to mustard gas. They are straight and evenly and radially arranged. No characteristic vessels appear in the conjunctiva.

Twenty-seven rabbits were studied in this series, and it was concluded that lewisite has a more destructive effect than mustard gas. A table is included to show lewisite lesions and their varying severity in the eyes studied.

HUNTER H. ROMAINE, M.D.

Thygeson, P.: Cytology of Conjunctival Exudates. *Am. J. Ophth.*, 1946, 29: 1499.

The author's investigations were carried out in an attempt to evaluate the cytologic findings of conjunctival diseases. Over 2,000 examinations of conjunctival scrapings, exudates, and follicular expressions stained with Giemsa stain, Wright's stain, and the Hansel stain formed the basis of the article.

The most frequent cytologic reaction seen in acute and chronic conjunctivitis was a polymorphonuclear leucocyte reaction. A high polymorphonuclear reaction was found also in conjunctivitis associated with erythema multiforme, Reiter's disease, and psoriasis arthropathica. However, there was no leucocytic response in Neisseria catarrhalis and diplobacillary infections. It was concluded that the diagnostic significance of the polymorphonuclear-cell exudate was of limited value.

The eosinophil was found to be the cell having the greatest diagnostic value since, except for ocular pemphigus, an eosinophilia proved to be an almost certain indicator of conjunctival allergy. It was invariably present in the conjunctivitis of hay fever, the conjunctivitis due to drug and cosmetic allergy, and vernal catarrh in the acute, and usually in the quiescent, stage. An eosinophilia is not a characteristic of bacterial allergies and therefore not found in phlyctenular conjunctivitis.

Small numbers of basophils were not infrequently seen in nonallergic inflammations, but large numbers were characteristic only of allergic inflammations and tended to parallel the conjunctival eosinophilia.

Mononuclear cells, and the lymphocytes in particular, were consistently found in epidemic keratoconjunctivitis and acute follicular conjunctivitis (Beale). A pure reaction was also found in the acute herpetic conjunctivitis and the conjunctivitis secondary to molluscum contagiosum.

Plasma cells were rarely found except in trachoma.

The epithelial cells were found to be keratinized and usually covered with xerosis bacilli in vitamin A deficiency. Keratinization also occurred as a result of exposure, as in old ectropion, trachoma, or pemphigus. In keratoconjunctivitis sicca there was a keratinization of the epithelium and an increase in the number of goblet cells. No diagnostic changes were found in the epithelium of trachoma patients.

No diagnostic differentiation could be made between the expressions of the nontrachomatous follicles, but there was a significant difference between them and the trachomatous follicles. The latter were characterized by the germinal center cell, believed to be a lymphoblast, lymphocytes, plasma cells, occasional monocytes, and large macrophages (Leber cells). The nontrachomatous follicular material contained small mononuclear cells, mostly lymphocytes, a few lymphoblasts, and small monophages, but without the degenerative changes found in the trachomatous follicles.

The author believes that the cytologic examination of the conjunctiva is of diagnostic benefit in many cases of conjunctivitis.

ROGER H. JOHNSON, M.D.

Moncreiff, W. F.: Surgery of Congenital Cataract. *Am. J. Ophth.*, 1946, 29: 1513.

The author has presented his modification of the technique of needling congenital cataracts in patients between the ages of 1 year and 6 years. After widely dilating the pupil, the needle-knife is inserted through the limbus of its temporalmost portion, and a vertical incision is made in the lens capsule and into the anterior cortex. Multiple incisions in the anterior capsule and cortex are then made, the nucleus is cut into several fragments, and a few light strokes are taken in the posterior cortex without injuring the posterior capsule. If too much aqueous is lost before completing these maneuvers, it is restored with an

irrigator before continuing with a larger needle-knife. When the lens is thoroughly stirred up, the knife is removed and some aqueous is allowed to escape. The lens remnants are then irrigated with an anterior chamber irrigator through the needle-knife opening.

The author reports 6 such needlings in which he obtained clear openings with the first needling and without complications.

In discussion, the author states that he believes the needling should be done as soon as the pupil can be well dilated, and that both eyes should be cared for at once unless there is a definite contraindication. He believes that too much traction on the zonule and ciliary body can cause secondary glaucoma and iridocyclitis. His method of breaking up the lens into small pieces and irrigating them into the anterior chamber is designed to prevent glaucoma by leaving the lens remnants in front of the iris where they cannot push the iris forward. He does not believe that linear extraction or the Ziegler operation should be used in this age group—the former because of the danger of iris prolapse and the latter because of damage to the vitreous. ROGER H. JOHNSON, M.D.

Feigenbaum, A., and Kornblueth, W.: Posterior Ring Abscess of Metastatic Origin in Behcet's Disease. *Brit. J. Ophth.*, 1946, 30: 729.

The authors discuss posterior ring abscess of metastatic origin in association with Behcet's disease. The syndrome, which represents a chronic septic condition produced by the staphylococcus aureus, generally occurs in patients constitutionally predisposed to the disease by a debilitating illness such as tuberculosis. The following signs are usually present: aphthous stomatitis, ulcers, uveitis (recurrent iridocyclitis with hypopyon), retinitis, optic neuritis, and a skin condition resembling erythema nodosum.

In metastatic cases, the infective agent is brought to the eye by the vascular route; in traumatic cases it is introduced into the interior of the eye through the perforating wound. In either case the action of the organisms intraocularly is probably the same. Forty-two cases are reported in the literature—18 of metastatic origin and 24 of traumatic origin.

A case of metastatic nontraumatic posterior ring abscess of the cornea in a male patient 28 years of age, is presented. The authors believe that in combination with other etiologic factors, increased intraocular pressure is a factor in the production of a posterior ring abscess. JOSHUA ZUCKERMAN, M.D.

EAR

Hirschfeld, H., Jacobson, M., and Jellinek, A.: New Treatment for Hearing Disorders. *Arch. Otolar.*, Chic., 1946, 44: 686.

The writers describe a new treatment for hearing disorders, using a combination of amino acids and vitamins. Quick and lasting results seem to occur.

A brief comment on the pharmacology of the medications was given.

The medication was given in two ways. In the first, 2 c. c. ampules containing thiamine, riboflavin, pyridoxine, nicotinamide, choline, glutamic acid, histidine, methionine, and urea were used. The reasons for using these particular drugs were explained. In the second form of treatment the medication was given in capsule form and thus a wider variety of amino acids could be used. Vitamin A, thiamine, riboflavin, pyridoxine, ascorbic acid, nicotinamide, calcium pantothenate, cysteine, urea, tyrosine, choline, glutamic acid, liver concentrate, and dried yeast were in each capsule. The amount of each drug used was not given.

During the first 2 weeks of treatment, the patients received 2 c.c. intramuscularly 3 times a week and 2 c.c. twice a week thereafter for 12 injections, but more resistant cases may receive a second series of treatment after a pause of 2 weeks. This was supplemented by the daily oral administration of 3 capsules.

The clinical investigations were carried out in the Hard of Hearing Clinic of the New York Polyclinic Medical School and Hospital. Fifty-three patients were examined and treated there and 36 additional patients were treated privately. Thirty of those treated at the hospital showed great improvement, 13 some improvement, and 10 no improvement; 4 failed to continue treatment.

The full effect of treatment was usually reached within 2 to 4 weeks. Further treatment did not seem to give any additional advantages. Some patients kept the original gains, but in older patients it is advisable to continue treatment with the capsules.

Increase in acoustic perception was notable in the speech range, but the best gain occurred in the high tones. Some patients showed improvement in one ear only, which was usually the one that had the shortest duration of the deafness. A case of diplacusis binauralis dysharmonica was also treated and the phenomenon disappeared nearly completely.

The writers state that this medication may be of value in preventing acoustic disorders that occur after exposure to loud noises.

Included are data on the patients treated, including audiograms on different patients made before and after treatment. WILLIAM A. AHROON, M.D.

Krauss, F. H.: Penicillin Therapy in Otorhinolaryngologic Practice. *Arch. Otolar.*, Chic., 1946, 44: 647.

The authors carried out a study on the effect of penicillin in ear, nose, and throat diseases. They recognized the fact that poor results may be obtained in cases when it is not possible to get the drug in close contact with the infection.

A total of 113 cases were studied, including cases of acute and chronic sinusitis, of otitis media, and of mastoiditis. They have been grouped according to the method of treatment as well as on the basis of diagnosis. The procedure was as follows:

Sodium penicillin was used in all cases in a strength of 1,000 units to the cubic centimeter. In one series

of cases Proetz's displacement therapy was employed. In another series the solution was instilled directly into the maxillary sinuses. In the less severe infections the topical administration of penicillin by nose drops alone was the procedure followed. In infections of the middle ear the penicillin was introduced directly into the middle ear by pressure, and finally the topical administration of the drug was fortified by parenteral administration, 10,000 units being given every 3 hours by intramuscular injection for from 2 to 5 days. This method was employed particularly in cases of associated mastoiditis and chronic sinus infections.

Forty-seven cases were treated by Proetz's displacement therapy, all with excellent results. Treatment was given daily and each patient instructed to use 10 drops of the penicillin solution in each nostril every 3 hours during treatment.

About 25 per cent of the patients with acute or chronic sinus infection were treated only by use of penicillin nose drops. The results in this group were inconsistent and not entirely satisfactory.

Four children treated by the Proetz technique had good results.

Ten cases of antral infection were treated by the instillation of the penicillin solution into the maxillary sinuses. Six cases cleared up after the second instillation, and in 2 cases in which permanent windows were present, the infection was controlled with penicillin put into the sinuses every 3 hours for 3 days. Some failures occurred, even though similar cases gave excellent results.

The patients with chronic otitis who were treated usually had concomitant sinusitis. The latter reacted well to the penicillin medication, but the chronic otitis showed no definite improvement that could be attributed to the local use of penicillin. A special clinic was set up and all chronic ear cases were referred there. These were treated by forcing the penicillin solution into the middle ear with a pneumatic otoscope.

Acute otitis media responded very well to the intramuscular injection of penicillin when the disease was due to penicillin-susceptible organisms. When penicillin injected intramuscularly was used along with mastoidectomy in cases of acute mastoiditis, the results were excellent, as shown by the middle ear, and the wound became dry in an average of 3 days instead of the normal 7 to 10 days or longer.

The article includes several reports of successful and unsuccessful cases. Several tables are also included which show the results of the penicillin treatment in the different groups of cases.

WILLIAM A. AHROON, M.D.

Day, K. M.: Appraisal of Fenestration Operation: Report of 100 Cases. *Arch. Otolar.*, Chic., 1946, 44: 547.

The fenestration operation is undoubtedly the greatest otological contribution of the present generation. The trend seems to be towards success in a higher percentage of cases, but attempts to analyze reasons for success or failure are needed in the hope of further improvements.

If practical hearing of normal speech can be achieved by the operation, the author believes it to be far superior to the distorted hearing obtained with a hearing apparatus. If the improvement is insufficeint for the understanding of normal speech, the operation is considered a failure, regardless of the amount of improvement, since some form of hearing aid is still needed. Speech tests are a better indication of the ability to hear than the threshold level for pure tones. Some patients have practical hearing with a threshold level of 30 to 35 decibels; others require closer to a 25 decibel threshold.

The diagnosis of otosclerosis should present little difficulty. Ninety-four of 100 consecutive cases showed fixation of the stapes on testing with a probe at operation. Gelle's test is thought to be useful. The family history was positive in less than one-half of the cases, and some pink discoloration of the medial wall of the middle ear was seen in 30 per cent.

The operation is of greatest value in young adults, and of less and less value after the fourth decade.

Hearing loss by air conduction must be below the practical level for speech; bone conduction loss should be slight, especially at 2,000 cycles. Bone conduction audiograms are likely to be inaccurate. Patients who are psychologically unstable are accepted with hesitancy. A clean upper respiratory tract and freedom from nasal allergy are important. A rapid loss of hearing with diffuse discoloration of the inner wall of the inner ear indicating extensive involvement makes the prognosis more questionable. The operation has no effect on the otosclerotic process.

Irrigation of the wound with saline during operation is found to be a help, whether constant or intermittent.

Three minor changes from the standard technique of the Lempert nov-ovalis operation have been found helpful. The wedge of skin and tissue between the tragus and helix is not removed but a single line incision is employed at that area. A partial mastoidectomy is preferred to a complete exenteration, to produce more rapid healing, and reduce the size of the resulting air chamber closer to the original. Melted paraffin has been discarded and small pledgets of paraffin gauze have been substituted to hold the flap. Packs are removed on the fifth day.

Care is directed to the method of preparing the flap and removing tiny scales of bone which have adhered to the periosteal surface.

Results in the first 100 cases are given.

Some improvement followed the adoption of the nov-ovalis operation. In the last 50 consecutive cases out of 90 in which this technique was used, 46 patients have practical hearing, 1 patient has unsatisfactory hearing, 1 patient is unimproved, and in 2 patients hearing is worse. The fenestra closed in but one of the last 50 cases.

There have been no serious complications, no facial weakness, operative infections, nor dead laby-

rinths in the author's series of 100 cases. Postoperative infections in the cavity have been frequent after the first few weeks, but were superficial and did not affect the results. In 2 patients, acute secretory conditions of the middle ears developed some months after operation. In one of these the hearing showed a permanent loss of 10 to 15 decibels, but in the other patient hearing was recovered to the previous postoperative level. Four patients had an attack of suppurative otitis media at some later time but all recovered without damage to their hearing.

In 7 cases of pregnancy following operation, no appreciable loss of hearing in either ear was found to occur. JOHN R. LINDSAY, M.D.

MOUTH

Brown, J. B., Peterson, LeR., Cannon, B., and Moore, A. M.: Facial Asymmetry and Malocclusion from Hyperplasia of the Mandible. (Correction by Operation.) *Plast. Reconstr. Surg.*, 1946, 1: 284.

The authors report 1 case of facial asymmetry and malocclusion from hyperplasia of the mandible, and state that the condition occurs only rarely.

Progressive enlargement of the left side of the jaw with malocclusion was noted over a period of 5 years in a 27 year old female. The asymmetry was due to an increase in length of the ascending ramus and also to thickening of the body of the left jaw. The entire left side was out of occlusion, the discrepancy being 6 mm. in the bicuspid and first molar area. No associated systemic disease was present.

The condyle and its elongated neck were removed through an external incision curved down from the temple close to the crux of the helix and over the tragus.

Elastic traction was attached to previously placed multiple loop wiring, and maintained for 4 weeks.

The teeth were brought into occlusion, and the deformity was removed. Mastication has been satisfactory.

On microscopic examination, the bony substance was found to be normal. JOHN R. LINDSAY, M.D.

McNichol, J. W., and Roger, A. T.: An Original Method of Correction of Hyperplastic Asymmetry of the Mandible. *Plast. Reconstr. Surg.*, 1946, 1: 288.

The authors describe an original method for correction of this rare deformity.

Plaster models of the dental arches are made, and the existing occlusion recorded. The lower model is cut, is reduced in size if necessary by removal of teeth, and repositioned so as to correct the facial deformity and produce functional occlusion. The sections of the lower model are united. It now indicates which teeth should be extracted and the best location for sectioning the mandible. The method of fixation of the mandibular fragments is decided. Sectional cast cap splints of German silver cemented to the teeth are usually best. Removable locks are prefabricated by making a plaster model of the lower arch with the splints on the teeth, and cutting and adjusting it with reference to the predetermined bite.

The first stage of operation consists in bilateral complete section of the mandible at predetermined points, the removal of full thickness section on the long side, together with associated teeth and the removal of excess bone along the inferior margin of the mandible on the long side.

Although the mandibular nerves are sacrificed, the chances for continued function of the teeth are good.

The second stage of operation consists in the application of bilateral cancellous bone grafts to points of previous bilateral section 3 to 4 weeks after the first stage.

The third stage of operation is undertaken in from 5 to 6 weeks after the second procedure, at which time filling out of the concave side of the face by a soft tissue fat fascial dermal graft is accomplished.

The method described is believed to provide better functional occlusion and correction of facial deformity than simple resection of the head of the condyloid process on the affected side.

One case successfully treated by this method is described in detail. JOHN R. LINDSAY, M.D.

Brown, J. B., Peterson, LeR., Cannon, B., and Lischer, C.: Ankylosis of the Coronoid Process of the Mandible (and Associated Scar Limitation of Jaw Function). *Plast. Reconstr. Surg.*, 1946, 1: 277.

In gunshot and shell fragment wounds about the coronoid process, fibrous tissue formation or comminution of bone with fixation, or both, may produce ankylosis of the mandible and loss of mouth function.

An ankylosing process of the temporomandibular joint may extend to involve the coronoid process. An ankylosis starting in the region of the coronoid process may tend to extend to the joint but early treatment may prevent involvement of the articulation.

Treatment varies according to the extent of fixation. It includes active exercises with the use of a rubber block, forcible dilatation and blocking the mouth open, section of fibrous tissue and blocking, removal of the coronoid process with or without blocking, and resection of the jaw below the ankylosis to create a false joint.

While the extent of the ankylosing process may not be evident on examination, the coronoid should be approached first if injury points in that direction.

Of 27 patients with limited mouth opening, 8 had bony ankylosis involving the coronoid, 3 had severe soft tissue cicatricial involvement, 5 had a strong fibrous attachment between coronoid and zygomatic processes, 4 had trismus due to a foreign body in kinetic muscular areas. In 10, the trouble was due to scarring of muscle and surrounding tissues.

Foreign bodies causing trismus should be removed.

Surgical treatment for bony ankylosis involving the region of the coronoid process consists of removal

of the process from inside of the mouth and enough of the surrounding displaced bone to prevent reunion. The crux of the operation for ankylosis of the temporomandibular joint is removal of a wide enough area of bone and scar to prevent reunion. Fascial transplant is thereby made unnecessary.

Endotracheal ether or cranial block anesthesia is used. The intraoral incision extends along the anterior border of the coronoid, and the ramus is exposed by blunt dissection. The ankylosis is chiselled free. Usually the entire coronoid process is removed, to create a large defect and prevent reunion. Treatment is the same for bony or extensive fibrous tissue fixation. Bleeding may be controlled by packing. Postoperative jaw exercises with the use of a rubber block are important adjuncts to treatment.

JOHN R. LINDSAY, M.D.

Thoma, K. H., and Goldman, H. M.: Odontogenic Tumors. *Am. J. Orthodont.*, 1946, 32: 763.

The authors review 75 cases of odontogenic tumors for the purpose of (1) formulating a proper classification, (2) describing their structure, and (3) illustrating the inductive effects of one tissue on another in the production of mixed tumors.

The following classification is adopted:

I. Epithelial tumors (36 cases studied)
   1. Adamantoblastoma
   2. Enameloma

II. Mesenchymal tumors (15 cases studied)
   1. Odontogenic fibroma
   2. Dentinoma
   3. Cementoma

III. Odontogenic mixed tumors—odontomas (24 cases studied)
   1. Soft odontoma-epithelium and mesoderm
   2. Soft and calcified odontoma-adamantoblastoma arising in conjunction with a forming or completely formed odontoma; all sorts of histological variations due to the inductive effects of one tissue on another
   3. Completely formed odontoma with enamel, dentine, pulp, cementum, periodontal membrane
      (a) Compound (many small teeth)
      (b) Complex (irregular tooth structure)

As may be seen, the odontogenic tumors are either of epithelial or of mesenchymal origin and are either soft or calcified. The soft epithelial tumor is called adamantoblastoma; the calcified, enameloma. Likewise, the soft mesenchymal tumor is called fibroma; the calcified, if dentine is produced, is called dentinoma, and if cementum is produced, cementoma. The mixed tumors are designated under the name of odontoma and they may be (1) soft, (2) soft and calcified, and (3) completely calcified.

The authors describe in detail the structures of the various forms and use many photomicrographs for illustration.

The adamantoblastoma is either solid or cystic, both being clinically rather benign although malignant degeneration can occur. The frequent recurrence after operation is due to incomplete removal. The enameloma, also called enamel pearl, occurs at the bifurcation of the roots of molars and premolars, and between the roots or at the cervical margin of single rooted teeth. The odontogenic fibroma originates from the embryonic tissue of the dental papilla or follicle and, later, from the periodontal membrane. It may occur in the coronal or apical region of the tooth. If calcification occurs, it leads either to dentinoma, located in the coronal region, or to cementoma, located in the apical region, although the pure forms of both are very rare. The mixed tumors contain a variety of elements such as enamel, dentine, cementum, pulp, and periodontal tissue. In the soft types the stroma predominates, sometimes becoming fibromyxomatous. The epithelium may form a very minor component. In the soft and calcified types of tumor, all possible phases of dental production are encountered. Calcification of the epithelial cells leads to the so-called ghost cells. Intermingled cystic areas are common. The completely formed odontomas may be compound, containing numerous rudimentary teeth, and complex when the calcified structures show no resemblance to dental tissue. Both types are usually encompassed by a cyst membrane.

The inductive effects of one tissue upon another are well demonstrated in the mixed odontogenic tumors. The epithelium in these tumors seems to stimulate dentine formation. However, dentine production may also be initiated by fibroblastic activity in the absence of epithelial cells. Neoplastic adamantine tissue and enamel-forming ameloblasts account, in part, for the formation of the soft and calcified odontogenic mixed tumors.

T. LEUCUTIA, M.D.

NECK

Salter, W. T.: The Circulating Thyroid Hormone in Blood and Lymph. *West. J. Surg.*, 1947, 55: 15.

It appears that circulating thyroid hormone is intimately connected with protein, and with protein that can leak through capillary walls. The preliminary formation of this protein carrier perhaps explains the characteristic lack in the response to thyroid medication. The accumulating measurements of protein-bound iodine in the serum indicate that it is our best gauge of net thyroid function. The measurements in lymph and in tissues are only preliminary.

RICHARD J. BENNETT, JR., M.D.

Astwood, E. B., and Vanderlaan, W. P.: Treatment of Hyperthyroidism with Propylthiouracil. *Ann. Int. M.*, 1946, 25: 813.

The authors report their observations in 100 unselected cases of hyperthyroidism in which treatment with propylthiouracil was carried out over a period of 1 year. Dosage requirements varied from 50 to 150 mgm. per day. In the more severe cases, 50 mgm. every 8 hours was the optimal dose for restoration of metabolic equilibrium. In the milder cases, 50 mgm. twice daily was usually adequate. The

larger doses were given until the disease was believed to be under control, after which the smaller maintenance doses were employed. There were no significant evidences of poisoning with the doses used.

CLINTON H. THIENES, M.D.

Rawson, R. W., and McArthur, J. W.: What Has Thiouracil Taught Us about the Pathologic Physiology of Graves' Disease? *West. J. Surg.*, 1947, 55: 27.

Studies were made on 7 patients suffering from Graves' disease. The histology of the thyroid gland was studied from biopsy specimens taken before any therapy, after the administration of thiouracil, and also after the administration of thiouracil and iodine.

The mean acinar cell height before treatment with thiouracil was 13.2 micra. After thiouracil treatment, the average was 13.9 micra. After thiouracil treatment, plus iodine, the average was 7.2 micra.

The excretion of tracer doses of radioactive iodine in the urine was determined in 3 cases before beginning any treatment, and in 6 cases after thiouracil had caused a fall in the rate of metabolism to a standard level. The average excretion before treatment with thiouracil was 25 per cent of the administered dose. In the same 3 cases it had risen to 83.7 per cent after thiouracil treatment. In 6 cases the average radio iodine excretion was 80.3 per cent after thiouracil treatment.

The iodine values of thyroids removed at operation showed a total iodine average of 22.1, a thyroglobulin value of 7.0 mgm., and a nondialysable iodine average of 8.3 mgm. These values are comparable to the values attained from the thyroids of thyrotoxic patients upon whom thyroidectomy was performed after treatment with thiouracil only.

These findings suggest that the thyroid gland of Graves' disease becomes more hyperplastic under thiouracil treatment, that thiouracil prevents the utilization of iodine by the thyroid, and that notwithstanding this block to the collection of iodine produced by thiouracil, iodine causes involution of the thyroid gland in Graves' disease.

RICHARD J. BENNETT, JR., M.D.

Wright, L. E. A.: The Estimation of 2-Thiouracil in Plasma and Urine following Its Administration in Thyreotoxicosis. *Med. J. Australia*, 1946, 2: 800.

The author discusses the preparations of reagents, the colorimetric estimation, the estimation of the drug in urine, the preparation of standard curves for urine, the preparation of standard curves for oxalated or citrated plasma, the use of whole blood, the effect of altering the hydrogen ion concentration, the estimation of thiouracil in oxalated pooled mouse plasma, the distribution of 2-thiouracil between the red cells and plasma, the effect of other substances on the estimations, and the collection of urine and plasma.

The excretion of 2-thiouracil in the urine of 24 thyreotoxic patients who received different dosages is discussed. It was found that the action of 2-thiouracil in thyreotoxicosis is "quantitative" in nature. The requirements of the patient at a particular time can be found by estimating the excretion of the drug on normal fluid intake, and then the excretion of the drug on increased fluid intake. It is recommended that a fluid intake which is larger than usual be taken because of the smaller solubility of the drug in the urine, in comparison with its solubility in the plasma.

RICHARD J. BENNETT, JR., M.D.

Watson, E. M.: The Treatment of Toxic Thyroid Disease with Thiouracil. *Edinburgh, M. J.*, 1946, 53: 609.

This report is based on a series of 60 hyperthyroid patients treated with thiouracil. The dose of thiouracil used initially for adults was from 400 to 600 mgm. daily. The development of severe toxic reactions is most likely to occur during the first 3 weeks. The time under thiouracil therapy necessary to effect a satisfactory response depends upon: (1) the nature of the disease (toxic adenomas respond more slowly than "primary" hyperthyroidism); (2) the severity of the thyrotoxicosis; (3) the duration of the hyperthyroidism; (4) the size of the goiter; and (5) the previous treatment with iodine.

After from 6 to 9 months of successful therapy with thiouracil it is often possible to stop the drug with a continuation of the remission. This was accomplished in 20 of the author's 60 patients, all 20 of whom are still under observation. There is no condition of thiouracil escape or resistance comparable to iodine escape or resistance. However, a small percentage of patients, probably around 5 per cent, are refractory to thiouracil for some reason unknown at present. There were 5 such cases in this series of 60.

The author does not believe that thiouracil has supplanted the surgical treatment of goiter except in certain selected cases. He believes that most, if not all, toxic nodular goiters should be treated surgically, not only because of the variability of their response to thiouracil, but also because of the danger of malignancy. Lugol's solution is administered both preoperatively and postoperatively, and thiouracil is discontinued for a week prior to operation.

The blood iodine levels were determined in 43 of the patients. The administration of thiouracil brought a decline of the blood iodine in 32 of the 43 cases in which determinations were made. Similarly, in 36 of the 46 cases in which blood cholesterol determinations were made, a rise occurred following thiouracil therapy.

The use of thiouracil during pregnancy is a question deserving of careful consideration. Experimentally, it has been shown that hyperplasia of the thyroid gland and retarded development were presented by the offspring of mothers receiving thiouracil. Similar reports of thyroid hyperplasia in newborn infants of mothers treated with thiouracil have been recorded. The author believes that if the drug is given with caution thiouracil may be used during pregnancy. He advises that in such cases the basal

metabolic rate be maintained near the upper range of the normal. A high concentration of thiouracil is present in the milk of such mothers, and they should not be permitted to breastfeed their infants.

The author reports that 1 in 200 thiouracil treated patients succumbs to the toxic reaction of the drug. Agranulocytosis, simple leucopenia, drug fever, cutaneous reactions as well as gastrointestinal upsets, jaundice, lymphadenopathy, swelling of the salivary glands, myalgia, and arthralgia have been reported as complications of the use of this drug. While individual hypersensitivity is of the greatest significance in the determination of the toxic reaction, excessive dosage and intermittent courses of administration seem definitely to increase the number of toxic reactions.

Newer thiouracil derivatives, propyl thiouracil and ethylthiouracil, appear most promising. Apparently, thiouracil acts by interfering with the formation of thyroxine by preventing the utilization of iodine. The use of thiouracil in cases of angina pectoris is briefly commented upon.

F. J. LESEMANN, M.D.

Dobyns, B. M.: Exophthalmos and Tissue Changes in the Guinea Pig following Administration of the Thyroid Stimulating Hormone of the Pituitary Gland. *West. J. Surg.*, 1946, 54: 411.

Following the injection of thyroid stimulating hormone conspicuous exophthalmos occurs in guinea pigs regardless of the presence or absence of the thyroid gland or the testes. Concurrently, a generalized connective tissue reaction occurs throughout the body and a profound change occurs in the body fat. Fat depots are rapidly depleted and replaced by edema and connective tissue. Polymorphonuclear leucocytes and macrophages participate in this reaction and appear to phagocytize fat. Macrophages appear to become fibroblasts which lay down connective tissue.

As further evidence of profound changes in fat following the injection of thyroid stimulating hormone, great quantities of lipoid appear in the liver, kidneys, muscles, and in some epithelial and reticuloendothelial cells. Values for plasma lipoids are elevated and the polymorphonuclear cells of the blood stream have been found to contain increased quantities of fat.

The data suggest that as a result of the administration of thyroid stimulating hormone quantities sufficient to produce exophthalmos there is a generalized alteration in the metabolism of fat throughout the body and a connective tissue reaction is associated with it. Thus, many of the changes in the orbital tissue which produce exophthalmos are expressions of generalized tissue changes.

Troell, A.: Malignant Goiter. *Acta chir. scand.*, 1946, 94: 533.

In a series of 4,500 patients submitting to surgery of the thyroid gland, the author reports findings of malignancy in 42. In 18 of these, the condition was considered benign prior to operation.

Radical resection was carried out in some of the cases, and in others less extensive resection was done. Since the postoperative course was about the same in both groups, the author believes that usually a less radical operation should be performed.

The prognosis in cases of adenomatous goiters in patients over 50 years of age with a short anamnesis, change in voice, shortness of breath, and a high sedimentation rate, is believed to be unfavorable. Diagnosis is difficult, and no rigid rules of treatment can be formulated. However, x-ray therapy following surgery, or in inoperable cases, is believed to be important.

CLINTON H. THIENES, M.D.

Clerf, L. H.: Sarcoma of the Larynx; Report of 8 Cases. *Arch. Otolar.*, Chic., 1946, 44: 517.

The author states that sarcoma is a disease of adult life and that it occurs more commonly in men. Of the 8 cases of sarcoma of the larynx on which the present report is based, all were men. Six of the patients were from 49 to 59 years of age, one was 25, and one, 75. One had had a similar lesion 21 years previously.

The commonest lesion is fibrosarcoma. The tumor is single, often pedunculated, nodular, firm, usually not ulcerated, and relatively avascular. In the series were also 1 case each of fibro-osteosarcoma, chondrosarcoma, lymphosarcoma, and extramedullary plasmocytoma.

Diagnosis is difficult and can usually be made only by biopsy.

The patients in this group were treated as follows: in the case of chondrosarcoma and the case of fibro-osteosarcoma, laryngectomy was performed.

The case of lymphosarcoma was treated by irradiation. Three of the tumors were removed by thyrotomy, 1 was removed by a snare removing part of the arytenoid, and 1 by removing a segment of the vocal cord with cupped and tissue forceps.

Of 6 patients observed for 5 or more years postoperatively, only 1 patient died of metastases; 3 patients died of unrelated illnesses. Two patients are living and free from recurrence.

Two of the 8 cases have been observed for a period of but 5 months.

CLINTON H. THIENES, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Gerlings, P. G.: Pacchionic Granulations and Brain Hernias. *J. Lar. Otol.*, Lond., 1946, 61: 261.

Pacchionic granulations are described by the author to consist of arachnoidal flocks, separated by a thin endothelial dura layer, and connected with an intradural blood sinus. These granulations have a special function to perform, i.e., to influence the brain pressure.

Brain hernias, described as bulbous protrusions of brain tissue in the dura mater, always developed in pacchionic granulations. The author states that such brain hernias are almost exclusively found at the base of the skull, at the same sites of the pacchionic granulations.

The pathological importance of such brain hernias consists in the fact that they can conduct an otogenic infection, especially when the infection proceeds through the tegmen tympani or pyramidal apex.

During a mastoid operation, when the dura in the neighborhood of the tegmen tympani and in front of it is freed, a pacchionic granulation or brain hernia may tear off. Through the dural fistula thus occurring an inflammatory process could quickly give rise to a leptomeningitis. These pathways are considered to be a factor in the intracranial spread of such extradural infections as may arise in the mastoid area.

HOWARD A. BROWN, M.D.

Bennett, W. A.: Primary Intracranial Neoplasms in Military Age Group—World War II. *Mil. Surgeon*, 1946, 99: 594.

The author's material is derived from a comprehensive study of 446 intracranial tumors at the Army Institute of Pathology. These tumors were removed from World War II Army personnel of the age group from 18 to 38 years, inclusive. Accurate correlation with other series of cases is not possible because of the limited age group. Only primary intracranial tumors are included, and the general divisions of this series are based on the morphological classification as well as the pathogenesis.

The Cushing classification is followed, and the tumors are listed under their appropriate headings. A most complete pathological description of each type of tumor is presented with its general characteristics and special peculiarities. The article is interspersed with 106 illustrations of both microscopic sections and gross specimens. The clinical side is described by noting the symptoms, their duration, the order of their prevalence, and the clinical diagnosis. Under each tumor heading there is an enumeration of the minor procedures that were performed, such as spinal puncture, pneumoencephalography, and ventriculography. In addition, the number of craniotomies is tabulated and the mortality rate carefully evaluated. As far as information is available, an attempt is made to list the number of cases which were given x-ray therapy and those cases in which there was an associated history of trauma.

Of the 466 tumorss tudied, 281 (62.9%) were gliomas, and of this group only 3 (0.7%) are listed as unclassified. Glioblastoma multiforme was diagnosed in 102 cases (22.9%) and astrocytoma in 63 cases (14.1%). The authors call attention to the fact that this ratio was reversed in other series based on different age groups. The incidence noted here of medulloblastoma, 45 cases (10.2%), and pinealoma, 13 cases (2.9%), was considerably higher than in other series. Fifteen cases (3.4%) of neurofibroma and 39 cases (8.7%) of meningioma are reported, a lower incidence than in other studies. This suggests that these types of tumors are more apt to be noted in older age groups. In this series only 26 cases (5.8%) of pituitary adenoma are tabulated. The remaining tumors were sparsely distributed among the rarer types of neoplasms; in the miscellaneous group there were 2 cases (0.4%) which were regarded as unclassifiable.

A few general conclusions are drawn. There is no great variation in racial incidence. The immaturity as well as the location of the lesion is of importance in determining the development and duration of the symptoms. The mortality rate is greater in gliomas than in other major types of tumors. It is directly related to the size, location, and type of tumor. The author emphasizes the fact that in this study 10 per cent of all the deaths occurred after spinal puncture, encephalography, or ventriculography, or before any operative procedure was performed.

RICHARD C. SCHNEIDER, M.D.

McKenzie, K. G., and Proctor, L. D.: Bilateral Frontal Lobe Leucotomy. *Canad. M. Ass. J.*, 1946, 55: 433.

Prefrontal lobotomy or frontal lobe leucotomy, as the authors prefer to call it, has been the subject of a fairly voluminous literature in the United States for almost 10 years. The authors present a short history of the procedure and its rationale, followed by a discussion of the results obtained in 27 cases. The technique, as described, severs approximately three-fifths of the various association pathways between the frontal cortex and the thalamus and hypothalamus. These tracts run in the inferior portion of the white matter of the frontal lobes.

The operation is performed with a special instrument, called a leucotome, which is inserted into the frontal lobe through carefully localized burr holes ¾ inch and 1½ inches respectively from the sagittal plane, with removal of the intervening portion of bone. The instrument is a sort of wire snare which can be opened or closed; with the snare open, the in-

strument is rotated, thus severing the white matter.

Special care is necessary in evaluating the patient from the cardiologist's point of view. Although cerebral hemorrhage is said to be the most serious postoperative complication, no instance of this occurred in the present series of cases. Mild hypersexuality followed operation in about 25 per cent of cases (3 females, 4 males); the intellectual impairment was slight failure of orientation and memory, persisting from several weeks to several months following the operation.

In the selection of cases for leucotomy, all other standard methods of treatment had been tried and in all cases there was an underlying factor of fear, agitation, and impulsive behavior. A heavy battery of psychometric tests was employed in evaluating the patient after operation, as before operation the patient was inaccessible. The results varied with the type of mental disorder that was evident before operation. In the affective disorders, 86 per cent of the patients were improved or cured, and 64 per cent were able to carry on life outside a mental hospital. In the schizophrenic group, 58 per cent were improved so far as nursing problems were concerned, and 25 per cent were discharged from the institution.

It was calculated that in this small series of 27 cases, approximately $70,000.00 were saved in hospital care. The article is supported by suitable summary tables and instructive diagrams.

ADRIEN VER BRUGGHEN, M.D.

Cawthorne, T.: Peripheral Facial Paralysis. Some Aspects of Its Pathology. *Laryngoscope*, 1946, 56: 653.

In reviewing Kettel's series (1943) of 93 cases of facial paralysis in which the nerve was operatively exposed, the author shows that 31 of the patients suffered operative injury to the facial nerve in the fallopian canal proximal to where the chorda tympani leaves the nerve trunk. In 1 patient the nerve had been cut during operation at its exit from the stylomastoid foramen. Bell's palsy accounted for paralysis in 26 patients. In all of these patients there had been no response to faradic stimulation after 2 weeks, and in all but 4 patients taste on the anterior two-thirds of the tongue on the affected side had disappeared.

The author does not believe that failure of lacrimation on the affected side is a reliable test for a lesion of the nerve proximal to the geniculate ganglion. In many of these patients the nerve was found to be swollen and bulging above a positive constriction ring just above the stylomastoid foramen. At the site of the constriction many fine hemorrhagic streaks within the nerve were to be seen.

Chronic suppurative otitis media accounted for the paralysis in 15 patients; war injuries produced the lesion in 11 patients; basilar fracture extending into the petrous bone with severe damage to the nerve was present in 4 patients; neurofibroma of the facial nerve in 2 patients and of the acoustic nerve in 1 patient was surgically verified; and unusual accidents to the ear caused the paralysis in the remaining 2 patients.

Cawthorne has found, in agreement with Bunnell, Ballance and Duel, and other modern otologists, that surgical exploration of the facial nerve is feasible and more useful than has commonly been believed.

JOHN MARTIN, M.D.

Lathrop, F. D.: Facial Nerve Surgery in the European Theater of Operations. *Laryngoscope*, 1946, 56: 665.

The author points out that though Ney in 1922, Bunnell in 1930, and Ballance and Duel in 1931, demonstrated the feasibility of grafting the facial nerve in patients who had suffered traumatic paralysis of the nerve, the methods used for the care of such casualties in World War II were as haphazard as they were in the first world war. The various mechanisms of the military type of injuries, together with the resultant defects, are discussed at some length. This author believes that testing for the presence or absence of increased lacrimation on nasal irritation is of value in determining whether or not the injury sustained by the nerve is located distal or proximal to the geniculate ganglion.

The commoner methods used to treat traumatic facial paralysis are decompression of the nerve within its bony canal, end-to-end suture (not always possible even in a fresh wound), nerve grafting, hypoglossal facial anastomosis, and fascia lata slings for the sagging muscles.

In the author's group of 45 patients, the nerve was decompressed in 10, sutured in 12, grafted in 15 patients, and anastomosed with the hypoglossal nerve in 1 patient. In the remaining 7 patients it was impossible to obtain a pathway for neurotization of the facial musculature.

Any procedure which actually puts the nerve ends in approximation, such as end-to-end suture or grafting, is definitely to be preferred to any anastomotic or plastic surgical procedure. The author is a strong advocate of the rerouting method of Bunnell, which may allow end-to-end suture to bridge gaps up to 23 mm. long if the nerve is properly removed from its canal and moved forward of its old bed in the facial canal.

JOHN MARTIN, M.D.

SPINAL CORD AND ITS COVERINGS

Kennedy, R. H.: The New Viewpoint toward Spinal Cord Injuries. *Ann. Surg.*, 1946, 124: 1057.

The appearance of the present article is particularly gratifying in that it indicates a new enthusiasm for improved care of the patient with an injured spinal cord. The author is sufficiently a realist to know that injury to the cord is damage done, and that the essential cord lesion is not reversible, yet he, along with others now active in the care of the military paraplegic, is sufficiently optimistic to believe that with proper early and rehabilitative care these patients can be returned to effective, worthwhile living.

In contrast to the high mortality among patients with injured cords in the first world war, it is pointed out that except for those who died early of massive injuries, most of these patients have survived as a result of the greatly improved means of evacuation in the theater of war, with better early surgical care, and with more intelligent care after reaching this country. He advocates the use of tidal drainage for the care of the bladder, together with the other usual chemotherapeutic and vigilant nursing methods of keeping the urinary tract in good condition.

In no other patient is nutrition such an important matter. Up to 300 grams of protein may be needed daily to keep the patient in protein balance, and the diet should at all times be rich in caloric and vitamin content.

A brief discussion of the nursing care of decubitus ulcers is given, and it is pointed out that many of these ulcers can be most effectively treated by excision or graft, and that once they are healed it is much easier to keep the patient in a state of nutritional balance.

The rehabilitation of the paraplegic patient is concerned first with the problem of locomotion, be that by walking with braces or crutches, or by getting about in a wheel chair. Important, too, is the aid which these patients must be given toward psychological readjustment, since their great need is encouragement and the development of self confidence. To keep them merely alive as "living memorials to the skill of medical officers during World War II, but to no good purpose" is not sufficient. Each patient is a special problem, and each man is worthy of readjustment insofar as his injury will allow it.

JOHN MARTIN, M.D.

Ellis, V. H.: Injuries of the Cervical Vetebrae. *Proc. R. Soc. M.*, Lond., 1946, 40: 19.

The author points out the improvement in care and treatment of cervical fractures and dislocations, and the material reduction in the mortality rate, now approximating 16 per cent. Reduction of nearly all dislocations can be achieved by manipulation or traction, and open reduction is rarely required.

Skeletal traction is recommended, by means of tongs applied to the cranial vault or the zygomatic arches. The importance of damage to the interspinous ligament in cervical injuries is stressed, and fusion and stabilization of the spines with stainless steel wire is recommended after reduction has been accomplished. The author's experiences in several typical cases are reported individually.

HOWARD A. BROWN, M.D.

Estella, J., and Marazuela, J.: Posterior Dislocation of the Lumbosacral Intervertebral Disc (Luxación posterior del disco intervertebral lumbo-sacro). *Rev. españ. cir.*, 1946, 3: 181.

Two factors are responsible for the fact that the overwhelming majority of dislocations of the intervertebral disc occur in the lumbosacral region: the static factor, namely, the large dimension and height of the discs in that region, and the kinetic factor, namely, the weight of the body and the mobility of the vertebral articulations.

In regard to location, two types of dislocations may be distinguished, the posterolateral and the central. So-called spontaneous hernias are undoubtedly attributable to repeated minute traumas.

Two groups of clinical pictures may be distinguished. In the first group the symptoms are confined chiefly to the spine; the normal lumbar lordosis may be absent and scoliosis or kyphosis may be found. Movements of the spine are painful and pressure on the apophysis of the fifth lumbar vertebra also produces pain. In the second, smaller group, the symptoms are confined mostly to the lower extremities. Among them the contralateral Lasègue sign and Bonnet's sign (pain produced by forced flexion and adduction of the thigh) deserve attention.

The authors are of the opinion that myelography is indicated whenever the clinical examination justifies the suspicion of a herniated disc. They consider myelography as preferable to an exploratory laminectomy. While the myelogram in posterolateral hernia, especially the disappearance of the so-called "axillary pouches," is quite characteristic, it is not pathognomonic in central hernia because an extrinsic tumor of the cauda equina may produce a similar picture. However, extrameningeal tumors in that region are relatively rare.

So-called intermittent hernias (cog-wheel of Anglo-saxons) may furnish negative myelograms.

Two varieties of the cauda equina syndrome may be differentiated; in one, motor symptoms predominate while in the other sensory and sphincteric disturbances are predominant.

In posterolateral hernias the authors employ hemilaminectomy of 2 lumbar vertebrae, while in central hernias a bilateral laminectomy is unavoidable.

JOSEPH K. NARAT, M.D.

Erickson, T. C., Masten, M. G., and Suckle, H. M.: Intrathecal Use of Penicillin. *J. Am. M. Ass.*, 1946, 132: 561.

The use of penicillin has produced brilliant results, but there is the possibility of toxic reactions when it is given intrathecally. This report is concerned with 4 cases in which there were severe neurological complications with death in 2. References are made to the literature of similar complications, and the 4 cases are reported in detail.

The first patient had a staphylococcal meningitis and occipital lobe abscess and received 50,000 units of penicillin intrathecally one day and the next day, 40,000 units by the same route. Eleven days later, and after the drainage of the brain abscess, a flaccid paralysis developed although spinal block was noted before the second injection of penicillin. Laminectomy revealed extensive arachnoidal adhesions.

The second patient was a child of 2 years with a pneumococcic meningitis who received 15,000 units of penicillin daily for 3 days and a fourth dose after

an interval of a week. Following this an extraocular palsy developed and later a spinal block. Intraventricular injection of penicillin coincided with a shocklike state which led to death.

The third case was that of a cerebellar abscess of mixed infection. Ten thousand units of penicillin were injected into the drained abscess cavity with immediate and finally fatal untoward results.

The fourth patient had a pneumococcal meningitis and received 10,000 units of penicillin every 12 hours for 48 hours. The spinal fluid was thick and green and after the first intrathecal injection there was marked retraction of the head, neck, and body from which the 6 year old child finally recovered.

The myelopathies usually appear from 10 to 17 days after the initial intrathecal injection of penicillin with the lesion about at the tenth thoracic level. Irreversible damage may have been done to the spinal cord. Some patients are benefited and then have relapses suggesting encysted infection to which penicillin does not gain access. The reaction may not be local, as seen in case 4.

The total dosage and the concentration of the injected solution are two factors concerned in the untoward reactions. The reactions can be minimized by greater reliance on maximal parenteral doses of penicillin; intrathecally, solutions should be of low concentration, and a large number of units over 20,000 should be avoided. The intrathecal route should be used as little as possible.

ADRIEN VER BRUGGHEN, M.D.

PERIPHERAL NERVES

Tarlov, I. M., Hoffman, W., and Hayner, J. C.: Source of Nerve Autografts in Clinical Surgery. Technique for Their Suture. *Am. J. Surg.*, 1946, 72: 700.

The search for a satisfactory means of filling in large defects in peripheral nerves continues. The purpose of the present study is to indicate the nerves which are usable as autografts. Homografts have been very unsatisfactory. The autografts must be made up of relatively unessential nerves and used in the form of cable grafts. No special difficulty is encountered in the use of (mainly) sensory autografts to fill gaps in motor nerves.

Actually the problem resolves itself into determining the obtainable length and the diameter of the unessential nerve to be used. The choice of nerve to be used depends on several factors: ease of surgical exposure, diameter, available length, and the degree of disability following its removal. The authors indicate the areas of sensory deficit after removal of the nerves.

Use of the following nerves is proposed: intercostal nerves, sural nerve, lateral femoral cutaneous and posterior femoral cutaneous nerves, saphenous nerve, and medial cutaneous nerve of the arm and of the forearm. All of these are about 2 mm. in diameter, and from 12 to 25 cm. are obtainable in each. The diameter of the peripheral nerve containing the gap to be bridged is also shown; for instance, the median nerve at the wrist has a diameter of 3.5 mm., and the length of the gap is 7 cm. The intercostal nerves to be used have a diameter of 1.5 mm., and by squaring these figures the ratio is 12.3 to 2.3. Six strips of intercostal nerve 7 cm. long will be required. The cable graft should be somewhat longer than the gap to be spanned.

Hitherto the problem has been that of a technical means of suturing the cable graft to the injured nerve. This is accomplished by using autologous unmodified plasma as a suturing agent. Tantalum foil cuffs are definitely contraindicated. Suitable apparatus in the form of molds is necessary, and good results have been obtained with the method in experimental animals. The results in man are uncertain but the method should be tried before recourse to orthopedic operations. ADRIEN VER BRUGGHEN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

De Santiago, A. P.: Tuberculosis of the Breast (Tuberculosis de la glándula mamaria). *Bol. Soc. cir. Uruguay*, 1946, 17: 205.

Because of the infrequent occurrence of tuberculosis of the breast, the author reports 3 cases occurring in women. The disease occurs during the age of sexual activity, between the ages of 20 and 50 years, and is most frequent in parous patients. It is usually unilateral, predominantly on the right side.

There appear to be five avenues of infection: (1) through the ducts, (2) through the skin directly, (3) by direct extension from neighboring foci, (4) by the hematogenous route, and (5) by retrograde lymphatic spread from cervical or axillary nodes.

From the standpoint of pathologic anatomy, the lesions may be (1) acute, miliary, (2) nodular, (3) disseminated nodular, (4) confluent, (5) a "cold" intramammary abscess, (6) sclerosing, and (7) an obliterating type.

The problem whether endocrine factors play a role in the production of the various types of the disease is brought up.

In the differential diagnosis, cancer is the most important consideration, particularly in the nodular and sclerosing types. The author advocates the use of x-rays with nitason (an opaque medium). The prognosis is varied, the condition ranging from a mild, benign entity to one which runs a fatal course in only 10 or 12 months.

The treatment is surgical and ranges from simple resection to radical mastectomy, according to the indications of the lesions, and should be supplemented by general measures against tuberculous infection.

Numerous illustrative photomicrographs and sample roentgenograms of breasts injected with radiopaque media are included.

HIRAM T. LANGSTON, M.D.

Brachetto-Brian, D.: Five Cases of Sarcoma of the Female Breast (Cinco casos de sarcoma de la mama en la mujer). *Arch. Soc. argent. anat.*, 1946, 8: 35.

In 10,000 tissue examinations, 350 mammary tumors were discovered; of these, 138 were benign and 212 were malignant. Two hundred and seven of the 212 malignant tumors were epithelial in origin and 5 were classified as sarcomas. Therefore, the sarcomas made up 2.36 per cent of the malignant mammary tumors and 1.04 per cent of all the mammary tumors.

The cases of sarcoma are presented, with case records, photographs of the gross specimen, and photomicrographs. These 5 sarcomas were classified as reticulum cell sarcoma, fibrosarcoma, adenofibromixosarcoma (2 cases), and adenofibrosarcoma.

HIRAM T. LANGSTON, M.D.

TRACHEA, LUNGS, AND PLEURA

Sweet, R. H.: Lobectomy and Pneumonectomy in the Treatment of Pulmonary Tuberculosis. *J. Thorac. Surg.*, 1946, 15: 373.

In cases of pulmonary tuberculosis it is striking to find with what frequency the hilar structures are relatively free from evidence of active disease. Lymphadenopathy, also, is rarely encountered, except for evidence in the form of calcification of an old infection. The frequent widespread dissemination of the disease throughout the lungs in the early phases of its development is remarkable. In almost all cases, the disease is found to be bilateral, and it is often spread throughout all the lobes of both lungs. Only a few of these foci develop into serious lesions, but at operation they can be identified as small, yellowish, firm nodules, which can be seen or felt. In many cases in which apparently new foci of activity develop in the remaining lobes or in the opposite lung, one can usually demonstrate that these areas were present, but almost imperceptible, in the early roentgenograms. These areas are responsible for the so-called postoperative spread of the disease, which is, in reality, a reactivation of pre-existing small foci.

It is obvious, therefore, that tuberculosis does not lend itself to surgical extirpation, in the sense that the entire diseased area can be removed.

In the absence of a certain degree of natural resistance, no surgical procedure can be expected to succeed in tuberculosis. However, no satisfactory method exists whereby this factor can be assessed. Because of this lack of natural resistance, apparently favorable cases present disappointing results, and because of its presence, apparently unfavorable cases show surprisingly good results.

In both the lobectomy and pneumonectomy groups, the greatest number of failures occurred in the cases presenting large cavities with marked pulmonary destruction. The mere fact that a patient develops large cavities in the lungs is evidence that his resistance to the disease is ineffectual. To avoid a high mortality rate and a high incidence of reactivation, therefore, he should not be subjected to extirpative surgery.

On the basis of the 63 cases in this series, it is not possible to say that those in which the disease was considered suitable for thoracoplasty did better in the long run, as a group, than they would have if thoracoplasty had been done.

Lobectomy and pneumonectomy in tuberculosis can be performed with a degree of safety which makes it proper to consider their use in the treatment of suitable cases. No absolute indications or contraindications can be applied. The best results followed pneumonectomy in cases of bronchostenosis and thoracoplasty failure, and lobectomy in those

which might otherwise have been treated by thoracoplasty.

Extirpative surgery has failed to solve the problem of management of cases with enormous cavities which do not respond to collapse therapy. Nor is there definite evidence that lobectomy is superior to thoracoplasty with regard to end-results.

Because pulmonary tuberculosis is not primarily a surgical disease, the hope for future progress in its management lies in the development of some medicament which will overcome the invading organism, and thus prevent further progress of the condition. SAMUEL KAHN, M.D.

Tosi, B., Gramazio, V., and Ingrao, F.: The Surgical Treatment of Large Tubercular Cavities of the Superior Lobe. (Il trattamento chirurgico delle grandi caverne tubercolari del lobo superiore). *Minerva med., Tor.*, 1946, 37: 459.

In the treatment of tubercular cavities 5 cm. or more in diameter, the author found that intrapleural pneumothorax was inefficient and he advised abandonment of this method. However, extrapleural pneumothorax is especially indicated in the cases with an active process in which the large cavity is accompanied by other destructive foci within the surrounding tissue of the lung. Extrapleural pneumothorax should be given preference in the cases which necessitate the intracavity aspiration of Monaldi in preparation for thoracoplasty. Aspiration diminishes not only the toxic manifestations, but also the size of the cavity, so that the number of ribs to be resected is smaller. Because cavities would refill if aspiration alone were used, and because a rigid large cavity cannot collapse by this method, the treatment of choice is aspiration followed by thoracoplasty. Thoracoplasty with the apicolysis of Semb is limited to the cases in which the cavity is not excessively full.

Extrapleural pneumothorax is contraindicated in cases with cavities close to the periphery of the lung and with inflammatory processes in the extrapleural tissues. As the condition of the lesion in the lung improves, the grave problem of re-expansion of the lung with large cavities presents itself.

ARTHUR F. CIPOLLA, M.D.

Tricerri, F. E. P., Langer, L., and Naclerio, E.: Bronchial Adenoma (Adenoma bronquial). *Prensa méd. argent.*, 1946, 33: 2207.

This report comprises a review of 12 cases of bronchial adenoma treated by resection (8 pneumonectomies and 4 lobectomies) on the service of R. H. Overholt, Boston, Massachusetts. Since the report in 1946, 3 additional cases have been successfully treated. The earliest case was seen in 1933.

The entire topic is reviewed at some length from the standpoint of the clinical picture, diagnosis, pathogenesis, and treatment. The opinions concerning the nature and behavior of these tumors are illustrated in the attitude taken in their treatment.

The possible forms of treatment include (1) irradiation, (2) bronchoscopic management, which includes implantation of radium needles, electrocoagulation, and removal by local resection, and (3) resection in the form of lobectomy or pneumonectomy. These lesions are considered as indications for resection because only in this manner can the frequent extrabronchial extensions be cared for, the potential malignant aspects of the tumor be obviated, and the frequently concomitant and irreversible lung damage secondary to prolonged bronchial obstruction be managed. Irradiation is believed to be of little value, and bronchoscopic management is limited by the hazards of severe hemorrhage and the inaccessibility of the extrabronchial extensions.

Two of these cases had metastases to the regional lymph nodes.

The extent of resection is dependent on the location and size of the tumor, the extent of the secondary changes, and the associated findings at operation.

Illustrative photomicrographs and roentgenograms are appended. HIRAM T. LANGSTON, M.D.

HEART AND PERICARDIUM

Blalock, A.: The Surgical Treatment of Congenital Pulmonic Stenosis. *Ann. Surg.*, 1946, 124: 879.

Because, in cases of congenital pulmonic stenosis, the atretic or constricted area is in the pulmonary conus itself, it was doubted that incision or partial excision of the stenotic area would result in permanent improvement. Experimentally, it was then found that creation of an artificial ductus arteriosus resulted in an increase in the arterial blood oxygen saturation of animals in which a high degree of chronic arterial unsaturation had been produced.

The author discusses the application of this experimental work to human beings in whom the results were much more striking than had been anticipated. Operation in these cases is indicated when there is evidence of inadequate blood flow to the lungs. Of diagnostic aid are the absence of visible pulsations in the lung fields, fluoroscopy, and roentgenographic evidence that the pulmonary artery is small in size. There are many borderline cases wherein accurate preoperative diagnosis is difficult, if not impossible. If, in these last cases, the patient seems to have a hopeless prognosis without operation, the author believes that exploration is indicated. If doubt still exists after exposure of the pulmonary artery, the intra-arterial pressure of this artery is determined with a water manometer. A pressure greater than 300 mm. of water, at present, is held to contraindicate anastomosis. Age limits suitable for this operation have not been established. Operations have been successfully done on an infant of 5 months and an adult of 21 years. It is believed that the operation should be performed on subjects between the ages of 2 and 10 years. Absence of cyanosis in children at rest, who have little or no tolerance to exercise, requires that arterial oxygen saturation should be determined under basal conditions and immediately after exercise; a definite decrease in the saturation after exercise in cases wherein it is be-

lieved that inadequate pulmonary blood flow is the cause, makes necessary a consideration of operative intervention.

The most important change in operative technique has been that instead of the approach on the left side of the chest to utilize a subclavian artery for the anastomosis, the approach is made on the side on which the innominate is located, usually, but not always, the right side. Exposure of this vessel offers a wider choice of vessels for anastomosis and is also of advantage in case the subclavian artery is used, because, when the subclavian branch of the innominate is used the angle caused by the anastomosis of this branch is not as acute as when the subclavian branch of the aorta is used. Despite the multiplicity of variations in arteries arising from the aortic arch, there has been in every case a systemic artery suitable for anastomosis to a pulmonary artery. Variations in the position and size of the pulmonary artery were fewer than was anticipated. In the occasional case in which the right pulmonary artery is very short, it may be necessary to ligate and divide the vessel and to use the distal end for anastomosis to the end of the systemic artery. If, however, the pulmonary artery is freed of its pericardial attachments, this procedure will rarely, if ever, be necessary. In evaluating the alterations of oxygen saturation of arterial blood resulting from this operation, it is rather surprising, in view of the septal defect and the overriding aorta in cases of the tetrology of Fallot, that the arterial saturation has risen so greatly in many of the patients. The improvement in the general condition of the patients has paralleled the alterations in the blood saturation and the decrease in their polycythemia.

The author's series of cases numbers 110, with 25 deaths, a mortality rate of 23 per cent. These figures include all patients who were subjected to operation, irrespective of whether or not an anastomosis was done. The surgical procedures used were as follows:

1. Anastomosis between the end of a systemic vessel and the side of one of the two pulmonary arteries was done in 91 cases with a group mortality rate of 18 per cent (16 deaths).

(a) The subclavian artery was used in 46 cases with 4 deaths.

(b) The innominate artery was used in 36 cases, with 11 deaths. Two of these patients were subjected to autopsy; the findings were: (1) a single ventricle with insignificant pulmonary stenosis; and (2) transposition of the great vessels combined with pulmonary stenosis. The most common cause of death in this group was cerebral anemia or thrombosis.

(c) The end of the carotid was anastomosed to the side of one of the pulmonary arteries in 9 patients, with 1 postoperative death 9 months later.

2. An end-to-end anastomosis was attempted between the end of a systemic artery and the end of a pulmonary artery in 10 patients. This method was used because (1) the pulmonary artery was very short or (2) because the patient was very ill which made haste necessary. In this group there were 4 deaths; these latter patients had atresia of the pulmonary orifice and the vessel was too small for a satisfactory anastomosis. In the future, attempts are to be made, in similar cases, to effect an anastomosis between the end of the systemic vessel and a longitudinal opening in the side of the pulmonary artery. The deaths which occurred in this group of patients were due to:

(a) Mistaking the right pulmonary artery upper lobe branch for the main vessel which was very short in 2 patients. The subclavian artery was anastomosed to the end of the small artery supplying the upper lobe. Retrospection suggests that the main right pulmonary artery might have been divided and its distal end used for the anastomosis if the condition had been recognized.

(b) Anastomosis was not done in 6 patients. One of these patients died because of failure to locate the pulmonary artery at operation (it was also difficult to find the vessel at subsequent autopsy), and a second died because the patient's condition was too poor to withstand operation.

Postoperatively, none of the patients had empyema, mediastinitis, severe bleeding from the site of anastomosis, heart failure, or a Streptococcus viridans infection. There was no significant interference with the circulation of the arm on the side on which the subclavian artery was sacrified or used for the anastomosis. Weakness or paralysis of the opposite side of the body in patients in whom the innominate or carotid artery was used either had cleared or was diminishing in all who had survived the operation. Despite the fact that some of the operations were performed too recently to allow an evaluation to be made of the results, it appears that all of the patients, with exception of one (whose too vigorously manipulated subclavian became thrombosed), are improved. It is believed that the artificial ductus in the remaining patients is patent although a murmur cannot be heard in at least one of them.

EUGENE J. AUDI, M.D.

Sweet, R. H., Findlay, C. W., Jr., and Reyersbach, G. C.: The Diagnosis and Treatment of Tracheal and Esophageal Obstruction Due to Congenital Vascular Ring. *J. Pediat.*, S. Louis, 1947, 30: 1.

The authors report 2 cases of successful surgical intervention in patients whose symptoms were caused by a double aortic arch.

The first case, that of a 3½ month old male, hospitalized because of progressively severe paroxysms of coughing and wheezy respirations which began 10 days after birth, showed normal concentrations of serum calcium, inorganic phosphorus, and phosphatase as well as normal wrist roentgenograms. X-ray examination of the child's esophagus, with the aid of barium, revealed a posterior indentation at the level of the aortic arch; slightly caudal to this, there was an indentation of the right lateral margin of the esophagus. Nothing pathognomonic was found by plain chest films in the neck, upper mediastinal shadow, or lung fields.

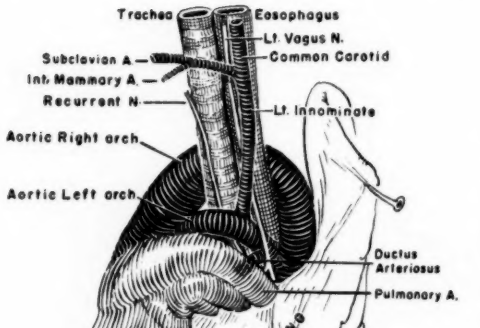

Fig. 1 (Sweet et al)

At operation, under ether-oyxgen intratracheal anesthesia, an incision was made through the fifth intercostal space on the left side; retraction of the pleura and pericardium overlying the great vessels revealed a right or dorsal aortic arch which arose from the usual location at the base of the heart. This ascended and then curved over the right main bronchus, proceeding posteriorly and behind the esophagus to emerge at the left posterolateral aspect of that structure. Here it was joined by another much smaller vessel, which arose from the first described vessel about 1 cm. above its cardiac origin and passed in front of the trachea and esophagus. From this junction, the artery descended in the normal course of the descending aorta along the left side of the vertebral column (Fig. 1). At approximately the midportion of the anterior vessel, or left aortic arch, there arose a long slender artery which extended through the superior mediastinum to the dome of the left chest where it branched into the common carotid, subclavian, and internal mammary arteries. This vessel was actually a left innominate artery. A patent ductus arteriosus connected the undersurface of the left arch with the pulmonary artery on that side, at a point approximately 1 cm. distal to the origin of the left innominate artery. The ductus arteriosus, occluded by external pressure without any untoward effect being noted, was divided between two ligatures of braided silk. The ventral component of the double aortic arch was similarly compressed at a point between the innominate artery and the stump of the ductus. The color of the upper extremities remained normal and the radial pulse did not change. The vessel was divided between ligatures at the point of compression. A sudden shift of the great vessels occurred immediately (Fig. 1 inset).

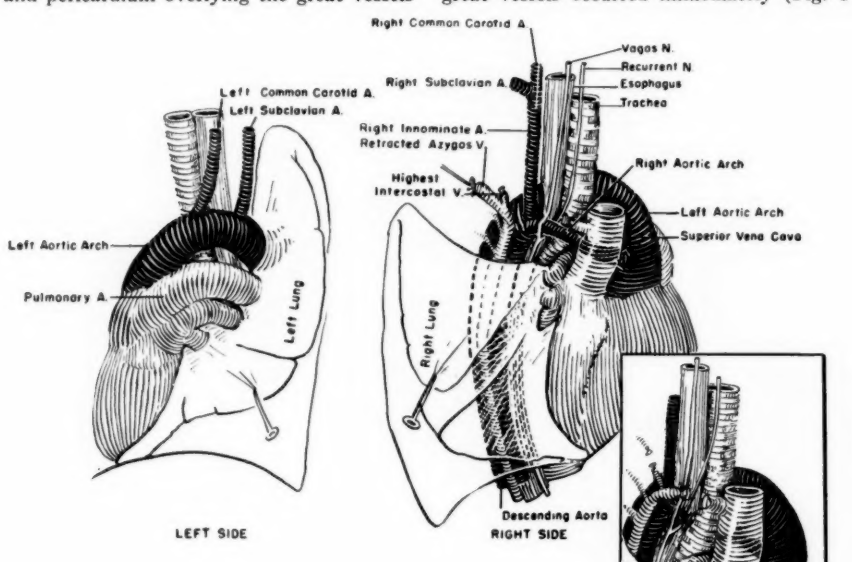

Fig. 2

The left innominate artery retracted superiorly and anteriorly. The exposed portion of the dorsal arch receded slightly posteriorly and to the right. The trachea and esophagus appeared to bulge forward and to the left. Postoperatively and following discharge from the hospital, the infant's condition improved.

The second case, a male of 9 years, had had three previous hospital admissions because of respiratory infections at 9 months (2 admissions), and at 2 years. On his fourth admission he was able to eat only liquids or strained foods, and even with these he vomited 2 or 3 times at mealtime. There was audible wheezing when he became excited. He had frequent upper respiratory infections from which recovery was slow. The x-ray examinations on his third admission had shown a prominence of the upper mediastinal shadow on the right. Barium confirmed this displacement and also revealed narrowing of the trachea at the level of the aortic arch posteriorly and on the right, probably due to pressure. The aortic arch appeared to be in normal position but an aortic arch on the right side could not be excluded.

A second operation was necessary in this case because it was found that the normally arising aortic arch, instead of following its usual course down the left thoracic gutter, curved behind the esophagus into the right chest. A right posterolateral thoracotomy incision was then utilized, the pleura being entered through the fifth intercostal space. It was found that the aorta emerged from behind the esophagus at a slightly lower level than that at which it was seen to disappear on the left side. It descended down the thorax along the right lateral margin of the vertebral column, curving gently to the left at its distal end so that it went through the diaphragm in the midline. At the point where the aortic arch became the descending aorta, a large artery branched off and was traced to the apex of the thorax. This was an innominate artery which bifurcated to form the right common carotid and right subclavian arteries. Further dissection of the mediastinal structures revealed a vessel connecting the ascending and descending portions of the aorta. It was found to arise from the ascending aorta just above the base of the heart and traversed the left posterolateral border of the superior vena cava. It then passed dorsally, slightly superiorly, and to the right, passing over the first portion of the right main bronchus at the point of its origin from the trachea. It joined the descending aorta at the level where the right innominate artery arose. The diameter of this vessel was about one-eighth that of the aorta. This was thought to be a persistent right fourth aortic arch. This superfluous segment of the vascular ring was doubly ligated with silk ties and divided, the severed ends separating immediately after division (Fig. 2 inset). No ductus arteriosus or ligamentum was found on the right. The postoperative course of this patient was uneventful except for an unexplained tachycardia which gradually subsided after several weeks.

The authors make the point that the observation in infants of respiratory wheezing or stridor, even without dysphagia (which is aggravated by deglutition), should arouse suspicion of the presence of a double aortic arch. These symptoms are usually noted shortly after birth, often become aggravated when the infant is fed, are absent during normal sleep, and are markedly aggravated by upper respiratory infections. Dysphagia becomes noticeable only when solid food is added to the infant's diet. Usually these infants do not have other congenital anomalies.

The most informative special examination is that of the esophagus following the ingestion of barium.

A study of previously reported cases suggests that an approach on the left side of the chest is the wisest for the surgeon to use because the surviving left fourth arch is usually more amenable to division as the right aortic arch almost always conveys most of the arterial blood. Of help in deciding which pleural cavity is to be entered is the fact that the lateral esophageal deformity usually indicates indentation by the larger of the persistent arches. The visualization of the side on which the main aorta descends along the vertebral column also is of aid in locating the lesser aortic arch, the vessel to be divided, which is usually on the same side. The embryology of the reported cases is described and illustrated.

EUGENE J. AUDI, M.D.

ESOPHAGUS AND MEDIASTINUM

Holt, J. F., Haight, C., and Hodges, F. J.: Congenital Atresia of the Esophagus and Tracheoesophageal Fistula. *Radiology*, 1946, 47: 457.

Esophageal anomalies have been classified into three large types:

1. Complete absence of the esophagus.

2. Atresia of the esophagus with an upper and lower esophageal segment, each ending in a blind pouch.

3. Atresia of the esophagus with tracheoesophageal fistula: (a) with a fistula between the upper segment and trachea, (b) with a fistula between the lower segment and trachea (the commonest anomaly), and (c) with a fistula between both segments and the trachea.

4. Single tracheoesophageal fistula, without esophageal atresia. This type is very rare.

The signs and symptoms of esophageal atresia are fairly characteristic. The inability to swallow fluids, attacks of choking, dyspnea, and cyanosis, especially during attempted feeding, and intermittent accumulation of mucus in the pharynx with resultant respiratory obstruction constitute a clinical picture which should not go unrecognized. Inability to pass a catheter into the infant's stomach permits a presumptive diagnosis of partial esophageal obstruction, but roentgenological examination is necessary for a positive diagnosis of complete atresia.

Since the anomaly of congenital atresia of the esophagus has now become amenable to surgical

treatment, the various methods of roentgen examination have assumed added significance in the diagnosis and management of the condition, and are discussed in some detail.

Surgical exploration of the anomaly was undertaken in 36 patients of a group of 45, and intrathoracic reconstruction of esophageal continuity was accomplished in 26 SAMUEL KAHN, M.D.

Rienhoff, W. F., Jr.: Intrathoracic Esophagojejunostomy for Lesions of the Upper Third of the Esophagus. *South. M. J.*, 1946, 39: 928.

Lesions and dysfunction of the esophagus have been a veritable challenge to surgeons throughout the world since Billroth in 1871 demonstrated experimentally that this structure could be successfully removed surgically. The observations of Billroth were soon applied clinically and as early as 1874 Czerny successfully resected the cervical esophagus for carcinoma in that region. Since that time many surgeons have applied themselves not only to the problem of extirpating the esophagus for growths occurring within that organ, but to the far more difficult feat of re-establishing the continuity of the gastrointestinal tract following an extirpation of this kind.

In the last decade and a half great advances have been made in what may be termed visceral thoracic surgery in contradistinction to operations upon the chest wall. In addition, patients with disease of the esophagus are not only recognized at a much earlier stage, but are better prepared for operation. The use of parenteral or intravenous feeding, penicillin lozenges, sprays, as well as intramuscular or intrathoracic injections, both preoperatively and postoperatively, and the maintenance of a high blood level of one of the various sulfonamides affords the surgeon today a far better operative risk than those of earlier years. Various forms of intratracheal anesthesia, particularly with cyclopropane, maintain the patient in a normal state of oxygenation with a minimal respiratory motion. Sometimes a state of suspended respiration can be maintained for quite long intervals. At this time there is also the free use of blood due to our blood banks which enable one to employ not one but two or even three transfusions at the same time.

Cezar Roux in Lausanne, in 1907, made the first attempt at total antethoracic esophagoplasty by mobilizing the jejunum with the mesentery.

The first successful case was the operation performed in Moscow, in 1907, by Peter Herzen. In 4 months he succeeded in making an artificial esophagus for a woman who had poisoned herself with sulfuric acid. Herzen added very important improvements to the methods of Roux: (1) unilateral exclusion of the mobilized intestine with anastomosis, instead of the bilateral exclusion used by Roux, and (2) the passage of the intestine through a slit in the mesocolon and gastrocolic ligament in order to prevent the possible compression by the transverse colon on the way to the subcutaneous tunnel. Herzen joined the intestine with the stomach by an anterior anastomosis.

The use of the jejunum as a substitute for the esophagus was given up for a number of years because of the difficulty in maintaining an adequate circulation in the mobilized loop. The method suggested by Roux, that is, dividing the first five vasa recta jejuni, was found to be hazardous to the maintenance of a sufficient circulation to the mobilized loop of jejunum except in quite young individuals who were victims of corrosive strictures of the esophagus. The length of the jejunum necessary to reach from the abdomen over the costal margin to the cervical region above the clavicle could not be obtained unless at least the first five vasa recta jejunalis were divided. In 1942, although unfamiliar with the previous work of Roux, the author, in the Johns Hopkins Hospital, successfully employed the jejunum as a substitute for the esophagus in a patient with a lye stricture running the entire length of the organ. This patient is now completely well and represents the first instance in which the jejunum was transplanted intrathoracically.

It became apparent that the intrathoracic transplantation of the jejunum would permit the use of a shorter length of the mobilized loop of the jejunum than that which would be necessary to encompass the subcutaneous route. Instead of ligating the first five vasa recta jejuni it was found necessary to divide only the second, third, and fourth vessels, which assured an adequate circulation to the entire length of mobilized loop necessary to be employed. In other words, sufficient length of mobilized jejunum to run along the entire length of the thoracic cage may be obtained by interfering with the circulation to a far less extent than by the method of Roux. Preservation of the first branch of the superior mesenteric artery is of the greatest importance in maintaining an adequate circulation to the mobilized loop of the jejunum. This first branch is the largest of all the vasa recta jejuni which diminish in size caudalward. To obtain the benefit derived from the preservation of this vessel, transection of the jejunum is performed far below, from 30 to 40 cm. from Treitz's ligament.

After division of the jejunum the oral end of the proximal loop, instead of the aboral end of the distal loop, is then brought into the chest. Peristalsis does not interfere with the function of this loop.

The importance of the following facts has not been emphasized in the past; namely, (1) that the intrathoracic transplantation of the jejunum requires a shorter loop of intestine, less mobilization, and, less interference with the mesenteric circulation than the long loop required by the subcutaneous route; and (2) that the transection of the jejunum 30 to 40 cm. from Treitz's ligament permits preservation of the first intestinal branch of the superior mesenteric artery and this insures a more vigorous circulation to the mobilized jejunal loop.

The case histories of 3 patients with different lesions that have been successfully treated by the

intrathoracic transplantation of the jejunum as a substitute for the esophagus are presented in detail.

The operative technique is carefully described.

The advantages of the use of the jejunum in reconstruction of the esophagus following resection of the latter for carcinoma are as follows:

1. The operation can be divided into two or more stages, which makes it unnecessary to subject the patient to an extremely formidable one stage operation as in the case when the stomach is employed.

2. The abdomen can be explored at the time of mobilization of the jejunum for metastases. The importance of this step needs no comment.

3. A gastrostomy may be performed without interfering with the subsequent operative procedure. If the stomach is anchored in this manner its use will be made more difficult, whereas the use of the jejunum is not interfered with. The ability to feed the patient by gastrostomy, particularly in the presence of extreme dysphagia, may result in a far better operative risk because of the general improvement in the clinical condition.

4. In case the cardiac end of the stomach as well as a portion of the esophagus is involved to such an extent that a major portion of the stomach must of necessity be resected, then the jejunum is available and can be used in almost any length desired.

It is believed that, particularly in patients afflicted with lesions of the upper third of the esophagus, the intrathoracic transplantation of the jejunum as a means for the reconstruction of an artificial esophagus has many advantages over other methods advocated in the past. Esophagojejunostomy would seem to be an operation that can be safely performed provided the jejunum is properly mobilized.

JOHN E. KIRKPATRICK, M.D.

Brea, M. M., and Santas, A. A.: Mediastinal Fibromyxoxanthoma (Fibromixoxantoma del mediastino). *Bol. Acad. argent. cir.*, 1946, 30: 977.

This is a report, in considerable detail, of a case of fibromyxoxanthoma originating in the mediastinum, projecting chiefly toward the right. The patient was a female, 34 years of age.

Symptoms had been present since 1939, consisting chiefly of chest pain. On December 22, 1943, this lesion, situated in the posterior part of the chest, was surgically exposed as it was assumed to be a hydatid cyst. However, aspiration of the mass indicated its solid nature. In the absence of intratracheal general anesthesia, its removal by an extrapleural approach was undertaken. The fist sized encapsulated tumor was removed. The pleura was torn in the process and an empyema resulted. The patient, however, made an entirely satisfactory recovery and has remained well for 3 years.

A brief review of the literature is given without a formal bibliography.

The report of this case is illustrated by roentgenograms and a gross and microscopic photograph of the surgical specimen.

HIRAM T. LANGSTON, M.D.

MISCELLANEOUS

Adams, H. D.: Arterial Injuries of the Thorax. *J. Thorac. Surg.*, 1946, 15: 365.

Technically, the surgical management of some of the more proximal arterial injuries was undoubtedly one of the most hazardous and difficult operations in war surgery. Those in the extremities low enough to permit use of a tourniquet and a direct dissection accomplished in a bloodless field were relatively simple. Those injuries located in the groin, neck, shoulder, and chest, however, required an entirely different approach and surgical management if the patients were to survive their operations. This was true particularly of the arterial injuries of the thorax with its close anatomic relationships, in which there is difficulty in obtaining wide and easy exposure.

The author describes in detail his operative treatment of wounds of the mammary and intercostal arteries, the axillary artery, and the subclavian and innominate arteries. These wounds were all acquired in warfare.

There were 14 cases of false aneurysm, many in combination with arteriovenous communications as well—6 axillary, 6 subclavian, and 2 innominate. There were no deaths or complications aside from occasional swelling and weakness of the upper extremity. No amputations were necessary and no treatment was required for any unusual circulatory disturbance in this respect. The patients recovered rapidly. Return of function of the upper extremity was variable, depending on the degree of the original associated nerve and muscle damage. The lack of cirulatory complications was undoubtedly the result of the age of these patients and most probably this procedure could not be done in an older group of patients without more serious circulatory complications.

JOHN J. MALONEY, M.D.

Lahey, F. H.: Pharyngoesophageal Diverticulum; Its Management and Complications. *Ann. Surg.*, 1946, 124: 617.

Pharyngoesophageal diverticula originate at the junction of the esophagus and the pharynx from the pharyngeal dimple, a triangular space bounded above by the lowest fibers of the inferior constrictor and on each side by the oblique fibers of the cricopharyngei.

If there is any inco-ordination of the swallowing mechanism, pressure from the constrictors and the obstruction below from the unrelaxed cricopharyngei results in a bulge at the pharyngeal dimple.

Recurrent pressure on this weak point causes the bulge to become a sac, a false diverticulum made up of mucosa and submocosa and covered by a few remaining cricopharyngeal fibers

As the sac enlarges it extends downward and becomes filled with food until it lies parallel with the esophagus, with a true sac body, a true neck, and a small midline aperture into the true esophagus.

The third stage is the eventual outcome as the sac enlarges and extends further downward into the superior mediastinum.

Each of these stages has its own group of symptoms. Stage 1 usually has no symptoms. An occasional lodging of a dry piece of bread or cereal within the bulge results in attempts to dislodge it by hawking. Operation at this time is neither necessary nor advisable.

The symptoms of the second stage are produced by the sac when it is filled with food which is mixed with air and mucus. The sac moves with swallowing and is compressed against the vertebral bodies by changes in pressure of the sternomastoid, omohyoid, and sternothyroid muscles, and of the overlying thyroid gland. This produces unpredictable expulsion of food and mucus which may come into the mouth any time during the day or night. In addition, audible and frequently embarrassing gurgling may come from the patient's throat with swallowing. Unexpected nocturnal regurgitation may result in inspissation of the sac contents, strangulation, and the danger of lung abscess.

The third stage presents all the symptoms found in stage 2, with the addition of obstructive symptoms. It is important to understand this obstruction as attempts to pass an esophagoscope, bougie, or feeding tube may result in perforation. This obstruction is not due to the pressure of the large filled sac against the lateral esophagus as was first believed, but is due to traction on the esophageal wall by the heavy sac. This converts the diverticulum opening into a semitransverse one and the true esophageal opening into a semilateral one. This traction tends to pull the two lips of the opening into the true esophagus together and converts it not into an aperture but into a slit. Attempts at instrumentation cause the tube or esophagoscope to pass into the blind sac and may easily lead to perforation with serious mediastinitis. The author has seen 4 cases of this.

Besides obstruction, complication of an esophageal diverticulum of the pulsion type may be produced by the development of a carcinoma in the wall of the sac. One may be suspicious of this diagnosis when blood tinged mucus is expelled from the sac or x-rays show the sac edges to be irregular instead of having the usual sharp clear outline.

Dilatation is the only nonoperative treatment of pulsion esophageal diverticula and is applicable only to the stage 2 type. It is impossible in stage 3 and of doubtful value in stage 1. While dilatation in stage 2 may lessen the obstructive symptoms, it does not delay the increase in sac size, allay the noises, or prevent the danger of food or mucus inspissation. All dilatations should be done by passing a bougie over a string previously swallowed.

In the differential roentgen diagnosis of a pulsion diverticulum one must consider a high esophageal web, a high stricture of the esophagus, or a scar of a previously removed esophageal diverticulum. The distinguishing feature of a true diverticulum is the demonstration of its body and neck, and the spill over into the true esophagus of the thin barium mixture after the sac is filled. In the lateral view the thin line can be seen running from its neck down behind the sac, while in a spherical dilatation the thin line will emerge from the bottom.

The most desirable time to operate on a patient with an esophageal diverticulum is in the early portion of stage 2. At this time the sac is small, there are no inflammatory adhesions, there is a good neck, the opening in the esophagus is small, sac dissection is not difficult, and the patient is free of obstructive symptoms which may affect his health. The second stage of the operation is carried out without difficulty at this time, and there is less likelihood of recurrence. Operation during the third stage with a large sac is complicated by inflammatory adhesions, adherence of the sac to the posterior aspect of the pleura, a large rigid mediastinal cavity, the necessity of implantation of the sac on the neck, and a large opening in the esophagus which must be closed.

The patient is fed for 7 days through a Levine tube introduced into the stomach through the nose. Healing usually occurs by primary intention, but with large sacs occasional leakage may occur.

These wounds close by granulation and there is no danger of mediastinitis or fascial plane cellulitis when a 2 stage operation is done.

The author first operated upon these cases under local cervical block, but now he uses general anesthesia entirely, mainly ethylene, given with an intratracheal tube. The advantage of being able to find the sac under local anesthesia more easily is far overbalanced by the discomfort of the patient during the long operation.

The author stresses exposure and recommends a longitudinal incision parallel to the anterior border of the left sternocleidomastoid muscle extending from above the level of the junction of the superior thyroid artery and the external carotid down to the sternal attachment of the sternocleido-mastoid muscle.

After the incision is made and the platysma cut, the anterior edge of the sternocleidomastoid is freed from the underlying prethyroid muscles. When it is retracted the anterior belly of the omohyoid is identified. This is ligated at its insertion and tendinous part, and removed. The internal jugular vein is exposed and the inferior thyroid veins passing from the thyroid to it are ligated and divided. When the thyroid is retracted medially, the inferior thyroid artery is exposed. This is ligated and divided, as the sac of the diverticulum comes from beneath it (Fig. 1b).

The dissection of the sac is then carried out. The sac should be pulled away from the longitudinal esophagus so that the dissection between the inner wall of the sac and the lateral wall of the true esophagus can be carried accurately up to the neck of the sac. This is extremely important. In order to be sure one has completely accomplished the dissection of the neck of the sac, this dissection must be carried completely around the neck until the pale white membrane of the submucosa is shown (Fig 2a).

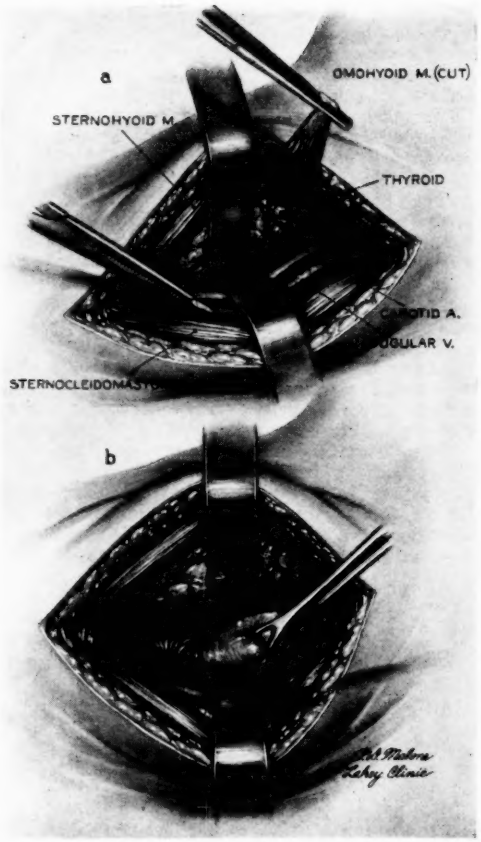

Fig. 1. (Lahey) a, Note in this illustration that the omohyoid has been severed at its tendinous portion and the point of insertion is not shown in this illustration as clamped. The anterior belly is, however, to be removed. Note the retractor pulling the thyroid inward and the retractor ready to pull the common carotid and the internal jugular outward. b, Note in this illustration the inward retraction toward the midline and the outward retraction of the large vessels. The diverticulum sac is completely dissected from its attachment to the longitudinal esophagus and pulled upward. Note the remaining circular fibers of the cricopharyngei or inferior constrictor muscles about the lower angle of the sac neck. These are to be severed.

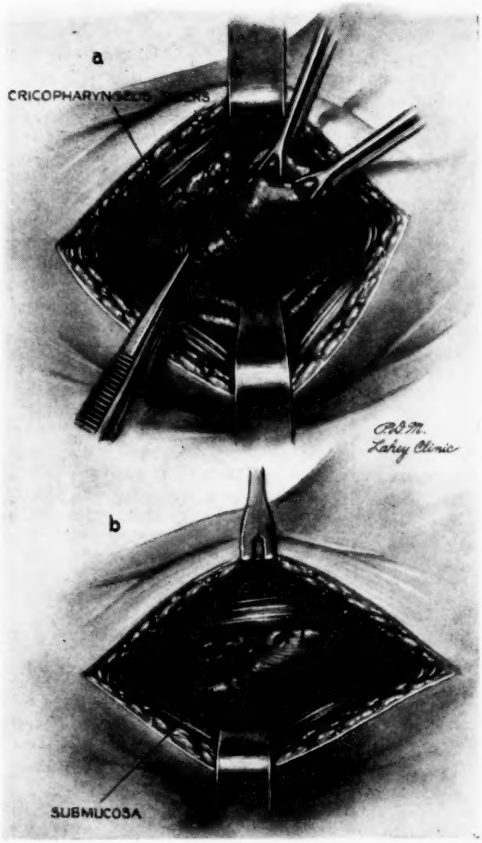

Fig. 2. a, Note in this sac the complete dissection of the neck, with the pale white surface of the submucosa. Note the removal of the sling fibers about the neck of the sac at the angle. The sac has been completely dissected from its attachment to the longitudinal esophagus so that it actually hangs by its neck. b, Note again the completely dissected neck with its pale white submucosa and that the sac has now been approximated to the prethyroid muscle. This illustration gives the impression that the stitches have passed through the sac. They have been passed through only the adventitia about the sac but care is taken to see that the needle does not penetrate the sac. This makes it possible to bury the small sac within the wound and to find it easily at the second stage of the operation. (Courtesy of J. B. Lippincott Co.)

There is a tendency for the inexperienced to stop short of complete dissection of the lower angle of the neck of the diverticulum sac. The use of a Berens-Beebe loupe will magnify the field and aid in dissection. If this angle is not completely freed, the resulting shelf or ledge will catch food and throw it into the incompletely removed sac which will result in a recurrence.

Dissection of the sac on the right side often is very difficult because it cannot be visualized. There is great danger of unwittingly making a hole in the sac neck at this time. If there is any difficulty or uncertainty about the safety of the procedure, the freeing of the right side should be delayed until the second stage when it can be done just as easily

with the added safety that the fascial planes and mediastinum are sealed off. When the sac is completely dissected, it is implanted in the wound and on the neck for 7 or 8 days if large; if small, its tip is sutured high up to the outer edge of the sternohyoid muscle, care being taken not to put a needle through the wall of the sac.

If the mediastinum has been widely opened a good sized pack is introduced into it and carried up along the edge of the esophagus to the level of the neck of the diverticulum. This is removed 4 days later. Care must be taken not to angulate the esophagus during implantation of a large sac in the wound.

The second stage of the operation can best be undertaken from 7 to 9 days later. As the wound is reopened the finger can be inserted in the old drainage canal and this permits easy separation of the granulation covered internal jugular vein and common carotid artery from the prethyroid muscles, thyroid, and esophagus.

The black silk sutures anchoring the sac to the prethyroid muscle are located and the sac is severed from its attachment. Its neck is easily wiped out with gauze. When the neck has been well freed at the first operation its relation to the true esophagus is easily established at the second operation. In patients with a small sac and narrow neck it can be doubly ligated with chromic catgut flush with the esophagus. The neck of the sac distal to the ligatures is clamped and the neck severed. A small amount of sodium sulfathiazole is placed over the ligated neck, a cigarette drain layed over this, and the wound reclosed.

The author advises complete reopening of the wound at the second stage, since closure of the sac posterior to the esophagus may be very difficult. In every case the Levine tube should be inserted through the nose into the stomach at the time of the second operation. All feeding should be maintained for 7 days through this tube to allow the closed esophagus to heal by primary intention.

In suturing a large sac opening in the true esophagus one should be careful not to narrow the esophagus. In one's enthusiasm to get rid of the entire sac, part of the right lateral wall of the esophagus may be pulled over and sutured to the left side; this would narrow the esophagus. A drain is inserted into the mediastinum and along the edge of the esophagus for 4 days.

The author has had 2 deaths among 209 cases. The mortality, hospital stay, and recurrence rate of the one and two-stage methods are about the same. The author prefers the two-stage method because of the safety from mediastinitis and fascial plane infections when occasional leakage occurs.

ROBERT R. BIGELOW, M.D.

SURGERY OF THE ABDOMEN

GASTROINTESTINAL TRACT

Jones, C. M.: Symposium on Gastrointestinal Bleeding. Diagnostic and Therapeutic Considerations of Gastrointestinal Bleeding. *N. England J. M.*, 1946, 235: 773.

Any consideration of bleeding from the gastrointestinal tract holds the immediate implication that the problem may be either medical or surgical. This is of primary importance and must never be forgotten, either in the discussion of the general problem or in the making of decisions in the individual case.

Because of the possible necessity of surgical intervention, gastrointestinal hemorrhage must invariably be considered from three distinct points of view. It must be thought of in terms of the actual site of the bleeding, which implies the necessity for accurate diagnosis whenever possible. The mechanism underlying the hemorrhage must also be carefully evaluated so that proper therapeutic measures may be decided on. The third consideration is the condition of the patient who is bleeding. Even before diagnostic or definitive therapeutic measures are undertaken, a decision must be made regarding the urgency of the situation in terms of shock and circulatory collapse.

A clear differentiation is needed between abrupt hemorrhage of shock proportions and minor oozing that, in the long run, may lead to more or less serious grades of anemia but is not an immediate threat to life. In major acute episodes, the immediate concern is the safety of the patient. Even under the pressure of exsanguinating hemorrhage, however, selected diagnostic procedures are indicated if successful definitive measures are to be carried out. At the same time, a knowledge of the hazards involved is essential in arriving at a final decision concerning therapy, whether medical or surgical.

The author reviews gastrointestinal bleeding in detail and stresses certain important points. Determination of the site and character of the hemorrhage—that is, exact diagnosis—is essential to proper, detailed therapeutic measures. Treatment must be directed toward immediate control of the sequelae of massive hemorrhage and, subsequently, toward adequate cure or management of the underlying cause. To achieve satisfactory results, the close co-operation of a well trained roentgenologist and of a competent surgeon is essential.

JOHN E. KIRKPATRICK, M.D.

Schatzki, R.: Roentgenological Examination in Patients with Bleeding from the Gastrointestinal Tract. *N. England J. M.*, 1946, 235: 783.

Massive hemorrhage from the gastrointestinal tract, particularly hematemesis, is one of the dramatic events in medicine that deeply impress both patient and physician.

The roentgenologist is burdened with the responsibility of finding the source of bleeding in a patient who is often sick and difficult to examine. If there is no clinical hint regarding the location of the point of bleeding—that is, whether it is in the upper or the lower part of the gastrointestinal tract—a scout film of the abdomen and examination of the large intestine should precede that of the esophagus, stomach, and duodenum. A careful study of the small intestine forms the last part of the examination. Usually, however, the type of hemorrhage indicates roughly which part of the gastrointestinal tract is the source of bleeding, and the suspected region should be examined first. Massive hemorrhage in the majority of cases arises in the upper part of the digestive tract, and the question to be decided first is when the patient can best and safely be submitted to barium and meal studies.

In the past the tendency was to delay such examination for 2 or more weeks, since it was thought that one at an earlier date not only endangered the patient, but also, because of his precarious condition, furnished somewhat unreliable results. In recent years this attitude has changed, and the manifold advantages of early roentgenological examination are recognized.

The author has not hesitated to examine the patient shortly after bleeding has stopped, or even during bleeding, although he does not examine patients in shock. The examination, without any palpation, is made with the patient in the horizontal position, peristalsis and gravity (turning him from side to side) being used as the means of distributing the barium over the inner surface of the esophagus, stomach, and duodenum. So-called "spot films"—that is, films taken during fluoroscopy at the optimal moment of filling and projection—are taken whenever they are deemed advisable, and are of great help.

The routine procedure in the roentgenological examination of the upper gastrointestinal tract in a patient who has had a recent hemorrhage is described in detail.

Good clinical judgment and common sense are essential in the selection of bleeding patients for early examination. Obviously, a patient should not be examined during clinical shock. It is usually unnecessary to examine one while he is actively bleeding. Blood clots that lie in the stomach handicap the proper interpretation of the roentgenograms, although they do not prevent the diagnosis of varices of the esophagus, of large ulcers of the stomach, or of the duodenum. It appears reasonable to wait for a period of at least 24 or 48 hours after an acute, massive hemorrhage.

Any patient in whom early examination has not demonstrated the cause of hemorrhage should be reexamined at a later date when palpation is possible and he is permitted to stand. Some bleeding lesions

are better demonstrated during the early examination, and others at the later, more convenient and more thorough one. In spite of every diagnostic maneuver known to the roentgenologist, the source of bleeding in a certain number of cases will remain obscure.

A few examples have been selected to demonstrate the problem with which the roentgenologist is confronted in dealing with a bleeding patient. A large number of other lesions, especially those in the small intestine and colon, have been omitted from this discussion.

The roentgenologist plays an important role in the handling of a patient bleeding from the gastrointestinal tract. In most cases he is burdened with the responsibility of demonstrating the anatomic lesion that has caused the hemorrhage, and to do so it may be necessary to examine every portion of the gastrointestinal tract.

Indications and contraindications for roentgenological examination soon after, or during, hemorrhage are discussed. JOHN E. KIRKPATRICK, M.D.

Linn, H. W.: An Analysis of Peptic Ulcer in South Australia, Based on a Study of 1,027 Case Reports. *Med. J. Australia*, 1946, 2: 649.

The author presents an analysis of 1,027 cases of peptic ulcer admitted to the Royal Adelaide Hospital, Adelaide, Australia, during the period between 1939 and 1944. The three main objects of the investigation were: (1) to review the incidence, death rate, and symptomatology of peptic ulcer in South Australia, and to see if and where these differ from the findings in other localities; (2) to differentiate between gastric ulcer and duodenal ulcer on the basis of etiology and diagnosis; (3) to inquire into the incidence and symptomatology of the combined ulcers and stomal ulcer.

The incidence, death rate, and symptomatology of peptic ulcer vary the world over. Duodenal ulcer was found to occur in younger people than gastric ulcer, while the proportion of males to females in both gastric and duodenal ulcer was 7 to 1. In the case of ruptured gastric ulcer, males predominated in the ratio of 19 to 1, and for ruptured duodenal ulcer, 28 to 1. The author is convinced that both gastric and duodenal ulcer are produced by the same etiological factor and that the variation in incidence and rupture rate between males and females may be due to a combination of varying anatomic and physiological factors with differing external and predisposing causes.

The all-over mortality rate was 8.0 per cent. Of these 82 fatal cases, 40 deaths occurred as the result of chronic ulcers; 39 of the patients had had ruptured ulcers; and 3 had had acute erosions of the stomach or of the duodenum. In the entire series of 1,027 cases, there were 159 ruptured ulcers and 763 chronic ulcers; it can be seen, therefore, that the mortality rate for the former is very high.

Fifty per cent of the patients in this survey were alcohol drinkers. This fact would appear to rule out the regular use of alcohol as a major cause in the etiology of peptic ulcer, although it is undeniably the cause of some recurrences of symptoms. Eight per cent of peptic ulcer patients smoked tobacco, but most men in the community do so also; hence, smoking must be eliminated as a primary factor, especially since 20 per cent of patients were nonsmokers. However, in a susceptible subject, there is no doubt that tobacco is an added irritant. Etiologically, no difference could be found between duodenal and gastric ulcer.

Conspicuous by their absence in this survey are references to psychosomatic factors, recurrences coincident with economic and emotional crises, and seasonal variations in incidence. Ruptured gastric ulcer is twice as common as ruptured duodenal ulcer in South Australia, while, the author states, the reverse is the case elsewhere.

The results of test meal examinations reveal a lower incidence of hyperchlorhydria, and a higher incidence of hypochlorhydria and achlorhydria than is usually expected. So much was this so that in any one case the result of the fractional test meal examination could not be taken as in any way aiding the diagnosis; 30.6 per cent of patients with chronic peptic ulcer who had undergone a previous gastroenterostomy were found to have a stomal ulcer during the 6 years of investigation.

The author makes a plea for similar inquiries to be undertaken in large centers of population elsewhere.

HAROLD LAUFMAN, M.D.

Visick, A. H.: Conservative Treatment of Acute Perforated Peptic Ulcer. *Brit. M. J.*, 1946, 2: 941.

A gradual trend towards conservatism has occurred during the past 25 years in the management of acute perforated peptic ulcer. Having noted the frequency with which, upon laparotomy, the perforations were found to be already sealed off by adhesions, and having observed several times during the course of some 400 gastrectomies the presence of dense sheets of adhesions which were interpreted as being the spontaneous closure of previous perforations, the author followed the lead of Bedford-Turner who, in 1945, reported a series of 6 cases of acute perforations which were treated nonoperatively.

During the past year, the author has treated conservatively a total of 14 consecutive, unselected cases of acute perforation, including 12 duodenal ulcers, 1 gastric ulcer, and 1 stomal ulcer. Essentially, the treatment consisted of the complete relief of pain by adequate morphine dosage, the prevention of further leakage by intermittent gastric aspiration, and the administration of intravenous sulfathiazole. Upon discharge, 11 of the patients were symptom free, although 1 patient subsequently required drainage of a subphrenic abscess, and 1 had a recurrence of severe pain within a month. Two patients died of pneumonia, and 1 patient died of subphrenic abscess and uremia.

The author concludes that there is justification for the further trial of conservatism in the treatment

of acute perforated ulcers, and pleads that this perforation may be anticipated and prevented by more urgent surgical treatment of chronic peptic ulcers causing severe symptoms.

WAYNE CAMERON, M.D.

Greengard, H., Atkinson, A. J., Grossman, M. I., and Ivy, A. C.: The Effectiveness of Parenterally Administered "Enterogastrone" in the Prophylaxis of Recurrences of Experimental and Clinical Peptic Ulcer. *Gastoenterology*, 1946, 7: 625.

A method is described for the preparation of an enterogastrone concentrate of uniform potency and suitable for parenteral injection in the human being. Therapeutic trial on 43 Mann-Williamson dogs and on 58 patients suffering from proved peptic ulcer over a period of years has demonstrated the probability that the material is effective in preventing recurrences during the period of its administration and for some time thereafter, as yet of undetermined length.

Roentgenological examination at the inception of treatment revealed that 51 of the patients had duodenal ulcers, 4 had postoperative jejunal lesions, 2 had gastric as well as duodenal ulcers, and 1 patient had a gastric ulcer. Many of the patients reported symptomatic relief within a few days after the injections were begun and most of them were free of distress after 2 weeks; in the remaining few approximately 2 months elapsed before relief from pain and distress was complete. In most instances, an interval of from 2 to 5 months was required before evidence of improvement in the condition was manifest on x-ray examination as interpreted by a trained radiologist.

The protection afforded cannot be explained on the basis of the action of enterogastrone in inhibiting gastric secretion, and the true nature of the agent concerned cannot be defined at present.

CHARLES BARON, M.D.

Heuer, G. J.: The Surgical Aspects of Hemorrhage from Peptic Ulcer. *N. England J. M.*, 1946, 235: 777.

There is a related group of patients who have massive, and sometimes fatal, hemorrhage but who fail to present a demonstrable ulcer. This group of patients has been a particularly discouraging one. Pathologically, the information regarding the source or sources of hemorrhage has been meager. At autopsy the pathologist has, generally speaking, failed to find an ulcer or other causes of hemorrhage.

A study of 337 patients admitted to the hospital because of massive hemorrhage due to peptic ulcer, is presented. Of these, 27 (8 per cent) died from hemorrhage—18 without having been subjected to operation, and 9 following operation performed on 31 patients during active bleeding.

On the surgical ward service of the New York Hospital, 49 (15 per cent) of all patients admitted with massive hemorrhage presented a fatal type of hemorrhage, and in all probability would have died without the intervention of surgery.

Two hundred and eighty-eight patients (86 per cent) who were admitted because of hemorrhage recovered without immediate or early surgical intervention.

In patients with the fatal type of hemorrhage the location of the ulcer, if duodenal, is on the posterior duodenal wall, and if gastric, on the lesser curvature. The blood vessels causing the hemorrhage are the pancreaticoduodenal and the right and left gastric arteries or their major branches.

In an attempt to differentiate patients with fatal and nonfatal types of hemorrhage, the most consistent criteria are failure to improve promptly under a strict regimen of bed rest, moderate doses of morphine, the withholding of fluids and food by mouth, adequate blood transfusions, and the recurrence of hemorrhage while the patient is on a strict regimen.

If operation to save life is decided on, it should be done within 24 or 48 hours of the onset of hemorrhage. The mortality in patients operated on early was 10 per cent, whereas that in patients operated on late (after 48 hours) was 70 per cent.

Large amounts of blood administered as transfusions before, during, and after operation are of great value in operations performed for the control of hemorrhage.

Local ligation of the vessels, giving rise to hemorrhage, has not consistently and permanently controlled hemorrhage. Local excision of the bleeding ulcer and gastric resection, including removal of the ulcer, have given the best results.

In patients who recover from hemorrhage on a strict medical regimen, the question of recommending surgery or of continuing a medical regimen is vital. No definite criteria for differentiating those who should be subjected to surgery and those who may properly be continued on a medical regimen have been developed. On the other hand, the occurrence of repeated hemorrhages, the chronicity and unfavorable location of the ulcer, and failure in the past to respond to a medical regimen in persons over 50 years of age, are factors indicating surgical treatment.

JOHN E. KIRKPATRICK, M.D.

Hollander, F.: The Insulin Test for the Presence of Intact Nerve Fibers After Vagal Operations for Peptic Ulcer. *Gastroenterology*, 1946, 7: 607.

This report contains a detailed description of a physiological test for the presence of uncut vagus nerve fibers in ulcer patients following any operation designed to interrupt all vagal stimuli to the stomach. The clinical success or failure of such operations is not discussed in this report. The test is based on the production of a degree of hypoglycemia of 50 mgm./100 c.c. or lower. To produce such a hypoglycemia, 15 units of insulin are administered intravenously, and its production must always be proved by a series of blood sugar determinations. A fractional gastric analysis is performed to determine whether the resulting vagal stimuli, set up centrally, are able to evoke any secretory response from the stomach.

The validity of this procedure for the purpose stated is supported by evidence derived from studies on dogs with a gastric pouch and on patients.

A positive response to the insulin test—consisting of a distinct rise in the curve for free acidity of the gastric aspirates, accompanying the production of an adequate hypoglycemia—indicated that some uncut parasympathetic fibers still connect the vagus center in the medulla with the stomach. This acidity curve affords no indication of the proportion of such fibers which remain intact; reasons for the qualitative character of the test are discussed. A negative response is suggestive but not necessarily conclusive proof that all the vagal fibers which pass to the stomach have been interrupted. First of all, there must be no doubt that an adequate hypoglycemia had been attained, and that neither a permanent nor a temporary anacidity was present, as shown by a fractional analysis with a suitable test meal. Second, in the presence of a gastroenterostomy or a subtotal resection of the stomach, the intestinal regurgitation may neutralize a small acid output and thus mask a true positive response.

Such an equivocal result can frequently be resolved by a repetition of the insulin test, especially if the dosage of insulin be increased somewhat. Only after these possibilities have been eliminated can a negative response be interpreted to indicate the presence of no uncut vagal fibers.

CHARLES BARON, M.D.

Samek-Ludovici, E.: Malignant Lymphogranuloma of the Stomach (Linfogranuloma maligno dello stomaco). *Minerva med.*, Tor., 1946, 37: 115.

The author adds a case of primary lymphogranuloma of the stomach to the 62 reported cases. This condition occurs chiefly in middle life and clinically is almost indistinguishable from cancer. The symptoms include epigastric pain appearing 2 or 3 hours after eating, often accompanied by nausea, vomiting, anorexia, nocturnal sweats, and weight loss. Achlorhydria may be present; hematemesis and melena may also occur and lead to death. A generalized bronzing of the skin is sometimes observed, with a secondary anemia. The leucocyte count is variable, with eosinophils up to 14 per cent. The temperature is apt to be low. The roentgenological picture closely simulates carcinoma but may show thickened gastric rugae or even concomitant foci in the stomach and intestines suggestive of lymphogranuloma.

The case reported was that of a 60 year old woman in whom the diagnosis of carcinoma was made. Gastric resection was performed and the typical tissue of Sternberg was found to be replacing the mucosa and widely infiltrating the muscular layer. The postoperative course was uneventful and the patient was treated with arsenicals, with satisfactory results until 2 months later, at which time the symptoms reappeared and a mass was discovered in the epigastrium. Death occurred 3 months after surgery.

EDITH B. FARNSWORTH, M.D.

Höyer, A.: Ulcus Simplex Jejuni. *Acta chir. scand.*, 1946, 94: 550.

About 100 cases of simple ulcer of the small intestine have been reported in the literature; in 51 of these, the ulcers have been localized in the jejunum. Dyspepsia and frequently melena are the essential symptoms, and the condition is rarely recognized prior to perforation. Grossly, simple ulcer of the small bowel is similar in appearance to ulcer of the stomach or duodenum. The etiology of the condition is unknown, and by definition, ulcers associated with tumor, syphilis, tuberculosis, foreign body, Meckel's diverticulum, and postoperative jejunal ulcers are not included in the group.

In the present article, the author reports an additional case of perforated ulcus simplex jejuni which, following excision and suture of the defect, went on to uncomplicated recovery.

WAYNE CAMERON, M.D.

Wilbur, D. L., and Camp, J. D.: Amebic Disease of the Cecum: Clinical and Radiological Aspects. *Gastroenterology*, 1946, 7: 535.

The present report comprises the cases of amebiasis of the cecum observed at the U. S. Naval Hospital, Oakland, California. The authors suggest that with the return of military personnel from areas in which people are heavily infected with amebiasis, it is important that clinicians and roentgenologists be on the alert for signs of this disease.

The syndrome varies widely and masquerades with a variety of clinical pictures resembling those of almost all types of cecal and appendical lesions. Symptoms may be absent. In such cases a diagnosis usually had previously been made of acute appendicitis, appendical abscess, or carcinoma of the cecum. It is important to rule out the erroneous diagnosis of acute appendicitis in such cases because of the disastrous results of surgical therapy in the presence of amebiasis. The mortality of such therapy incident to the Chicago epidemic of 1933 was 40 per cent.

The significant roentgenological changes in the cecum consists of spasm, dilatation, relaxation and abnormal patency of the ileocecal valve, inflammatory induration with "coning," and inflammatory tumefactive defects. The earliest lesions are those involving the mucosa, and the cecal walls lose their sharp, smooth character and are replaced by a finely granular or irregular contour of the mucosa, which may be associated with varying degrees of cecal spasm.

Cecal lesions of amebiasis were found by barium enema studies in 9 of 37 patients with stools which, on routine examination, contained cysts or trophozoites of ameba histolytica.

In the experience of the authors, the most valuable method of examination was the roentgenological study of the colon, whether or not symptoms were present or the stool examination was positive. Roentgenological examination was particularly useful in indicating the diagnosis of amebiasis in patients with a history suggesting previous disease of the appendix, and in those with hepatitis or otherwise un-

explained enlarged livers with abscesses of the liver when ameba or cysts could not be found in the stools or pus. HAROLD LAUFMAN, M.D.

Tashiro, S., and Zinninger, M. M.: Appendicitis: A Review of 936 Cases at the Cincinnati General Hospital. *Arch. Surg.*, 1946, 53: 545.

The present report is the third one in the authors' review of a series of cases of acute appendicitis treated at the Cincinnati General Hospital, Cincinnati, Ohio, since 1915, and covers the five year period from 1939 through 1943.

The incidence of acute appendicitis without perforation showed an absolute and relative increase, and the incidence of perforation showed a corresponding and gratifying decrease. A reduction was also noted in the use of catharsis and in the time elapsing between the onset of symptoms and admission of the patient to the hospital. However, negro patients as a group were admitted to the hospital at a significantly later period of illness than white patients, and as a group showed a higher incidence of catharsis.

The McBurney incision has been the customary approach to the appendix at this clinic for a number of years. The question of drainage remains unsettled. The incidence of pelvic abscess was greater in patients with perforation when the peritoneal cavity was not drained, but the mortality in this group was lower.

The mortality among patients with acute appendicitis without perforation was 0.49 per cent, as compared with mortality figures of 0.86 per cent and 1.03 per cent for the first and second series reported from this hospital. The mortality among patients with perforation and generalized peritonitis was 13.77 per cent as compared with 33.9 per cent and 17.2 per cent reported among patients in the two preceding reviews. The mortality for the group with abscess formation was 4.3 per cent as compared with 11.4 per cent and 10.1 per cent for cases included in the first and second reviews.

Penicillin was not used in any case of appendicitis included in this report. Sulfonamides were given to 114 of the 167 patients with perforation and generalized peritonitis, with a mortality rate of 11.3 per cent as compared with 18.8 per cent in the untreated group. The mortality among 93 patients with appendicitis and abscess formation was 4.5 per cent and 4.1 per cent respectively for the treated and untreated groups.

The reduction in mortality reflected in this review is attributed, at least in part, to an intensive educational campaign begun in Cincinnati in 1934.

EDWARD W. GIBBS, M.D.

Simpson, D. G.: Acute Appendicitis in the Aged. *Brit. M. J.*, 1946, 2: 986.

The author states that from 1 to 2 per cent of all cases of acute appendicitis occur in patients over 60 years of age, and the mortality in this group is from 25 to 30 per cent. The signs and symptoms in elderly persons are considerably different from the usual clinical picture in younger patients. With advancing years, the structure of the organ has altered, the lymphoid tissue has largely disappeared, and fibrous atrophic changes associated with vascular changes are present that cause an inability of the circulation to respond to the demands of inflammation. Hence the devitalized appendix, when subjected to obstruction by a fecolith, soon perforates. As the omentum and peritoneum frequently lack their "pristine ability" to localize the infection, general peritonitis results and a fatal termination is common. Thus the usual sequence of events in appendicitis is altered; pain, though nearly always present, is poorly localized and only becomes intense with the onset of peritonitis. As constipation is frequent, the pain is often misinterpreted as due to this. The general reactions of nausea and vomiting, fever, and elevated pulse rate are not found, and the localizing signs of rigidity, tenderness, and pain on rectal examination are vague and inconclusive, or absent. As a result, the patient neither feels nor appears ill, and frequently delays seeking advice until peritonitis has developed.

With the onset of perforation, pain, distention, vomiting, and fever appear, and, particularly with the presence of a mass, an incorrect diagnosis of intestinal obstruction may be made. In one series the misdiagnosis of appendicitis for carcinoma or bowel obstruction was 38 per cent. Elevation of the white count is of help in the differentiation.

In the operative treatment, it is recommended that incision be made in the right iliac fossa rather than near the midline to minimize peritoneal contamination. Where the diagnosis is in doubt, this route may be utilized well for the performance of a cecostomy to relieve obstruction of the large bowel.

An illustrative case at the age of 85, with survival, is discussed. WAYNE CAMERON, M.D.

Cohen, S. E., and Matthews, B. L.: Dissecting Diverticulitis of the Colon. *Surgery*, 1946, 20: 823.

Attention is called to a type of diverticulum of the colon which heretofore had not been described. The patient underwent a resection of the left colon for what was thought to be an obstructing carcinoma. The specimen revealed, in addition to the usual sacculations of diverticulosis, one long (9 cm.) diverticulum which had apparently burrowed within the mural structures. Microscopically the sinus space was situated outside the circular layer of muscle. It was lined with a chronic vascular granulation tissue, with occasional remnants of mucosal glands still present.

The authors interpret this type of intramural sacculation as a diverticulum which had its progression through the wall arrested, was turned distally, and then was propelled isoperistaltically within the wall of the bowel. When this cavity became filled with feces or gas, the patient developed signs of obstruction. The cloaca of the intramural diverticulum was edematous, thereby apparently causing closure and a ball-valve or tension mechanism. The authors apply the term "dissecting (intramural) diverticulitis of the colon" to this lesion. HAROLD LAUFMAN, M.D.

Ochsner, A., and Hines, M. O.: Carcinoma of the Colon; Analysis of 113 Cases. *South. Surgeon,* 1946, 12: 269.

The etiology of colonic carcinoma, as in carcinoma elsewhere, is not known except that in many instances the malignant neoplasm originates in solitary or multiple polyps. It is the belief of the authors that congenital polyposis is so definitely premalignant that carcinomatous change is prevented only by removal of the involved bowel, or the relatively early development of carcinoma is inevitable. Stasis at the flexures, which are relative points of fixation, are thought to be factors in producing malignant changes in these areas.

Carcinomas of the colon and the rectum are adenocarcinomas and may vary considerably pathologically from a large, bulky, fungating mass, which is likely to be found in the cecum, to a relatively small cicatrizing lesion producing complete obstruction of the bowel, which is found most frequently in the left colon, particularly the sigmoid, or to a small polypoid tumor with no encroachment on the bowel lumen. A relatively infrequent type of rectal and colonic carcinoma is colloid adenocarcinoma in which there is an overproduction of gelatinous material. Colloid carcinomas, although they occur infrequently, are of significance because they usually offer a relatively poor prognosis. As a matter of fact, gelatinous tumors of the rectum have been considered by Miles as not being curable by any known means. This entirely pessimistic viewpoint is rarely justified, however, even though the prognosis is bad.

Gilchrist and David showed that lymphatic involvement in these lesions is much more extensive than commonly considered. By employing a special technique in which the involved bowel and the lymph bearing areas were cleared according to the technique of Spalteholtz, they were able to demonstrate malignant involvement of a large number of lymph nodes. The size of the tumor also had little influence on the number of nodes involved. Although the extension is generally upward, in cases in which there is blockage of the normal lymphatic drainage retrograde extension may occur. Tumors at the level of the levator ani have a double drainage, i. e., upward along the superior hemorrhoidal artery and also laterally along the superior surface of the levator ani muscle. There can also be direct extension through the bowel, and beyond the bowel to the surrounding and adjacent structures. Hepatic metastases must always be considered because of the possibility of the tumor cells getting into the portal system and being carried through that system to the liver.

The sexual relationship in large bowel carcinoma varies according to different statistics. In the author's 113 cases, 52 (45.6%) were males and 61 (54.4%) were females.

The contents of the right colon are fluid, whereas the contents of the left colon are solid. Because tumors of the right colon are bulky and fungating, but do not produce a great deal of narrowing of the lumen, obstipation is relatively infrequent. On the other hand, because left-sided lesions are cicatrizing, particularly those in the sigmoid, and because the contents of the left side of the colon are inspissated, constipation is a relatively early manifestation. The passage of blood and mucus, an unexplained anemia, in an individual who otherwise is well and who has no symptoms, may be caused by a fungating, ulcerating tumor in the cecum.

The complaint of hemorrhoids or any other rectal disorders requires thorough investigation, because most rectal carcinomas have associated hemorrhoids. In all rectal complaints, a malignancy must be considered first. Most rectal lesions are within the last six centimeters of the anus, and these lesions can be detected usually by the examining finger. By means of proctoscopy or sigmoidoscopy, it is possible not only to visualize lesions in the rectum and sigmoid but also to obtain biopsies of the tumor.

Roentgenography is of little value in low-lying lesions. Fluoroscopic visualization of the filling of the bowel is essential. All patients with colonic and rectal carcinoma should have double contrast studies, in addition to the ordinary roentgenogram following a barium enema.

The treatment of rectal and colonic malignancies might be divided into two types, the preventive and curative. Since many, if not the majority of, colonic malignancies begin as benign polyps, the recognition of these benign lesions and their complete removal will prevent the development of a cancer. If the polyp is located in the rectum, below the peritoneal reflection, it can be removed through the proctoscope. Those lesions above the reflection of the pelvic peritoneum should be operated upon transabdominally, and the polyp removed. The curative treatment of colonic and rectal malignancies consists of complete removal of the involved segment of the bowel together with the possible sites of extension, both the direct and the lymphatic extensions.

In the presence of obstruction, decompressive procedures must be done as early as possible in preoperative preparation. If this is not done, the danger of perforation of the cecum, which is the most vulnerable site in a colonic obstruction, is considerable. After the performance of a decompressive cecostomy or colostomy, sufficient time must be allowed to elapse for the acute inflammation to subside and for the gut to regain its tone before any resection of the involved segment is attempted.

After the relief of acute obstruction, it is important to re-establish the normal nutritional status. Since many of these patients have lost weight and have been ill for some time, they are likely to have a contracted blood volume with resulting hemoconcentration. The ordinary blood studies give false values because they do not represent the amount of the total circulating blood constituents. Sufficient whole blood to re-establish the normal levels of cellular elements, hemoglobin, and protein should be given before operation is contemplated.

Sulfasuxidine and sulfathalidine have been used in the preparation of these patients. Neither of these substances is absorbed readily from the intestinal tract; the latter is effective in relatively small amounts.

Whenever possible, the operative procedure and anastomosis, when done, should be carried out aseptically. In abdominoperineal resections, the operation is performed almost entirely aseptically, because the bowel is divided by means of the actual cautery between crushing clamps. The clamp on the proximal end of the distal bowel is small enough so that it can be shoved down in the hollow of the sacrum together with the mobilized sigmoid and rectum without any contamination. The obstructive resection is done aseptically, and, also, it is desirable when possible to perform a "septic" anastomosis when a primary anastomosis is made. In the author's series a resection with primary end-to-end anastomosis was performed in 27 cases, of which 17 (62.9%) were done aseptically, and in 10 (37.1%) an open anastomosis was used.

Spinal anesthesia was preferred and used with very few exceptions. In the case in which there is some question concerning the resectability or operability, continuous spinal anesthesia is to be preferred because in this way it is not necessary to use a long acting drug if the condition proves to be inoperable.

The incision used for right-sided lesions is either a long paramedian or transverse incision. A transverse incision is used for lesions of the transverse colon, the splenic flexure, and descending colon. The incision for rectosigmoidal and rectal lesions is a left paramedian one, which permits a better access to the pelvis. In all right-sided lesions, a right colectomy is done. Unless there is a great deal of inflammatory reaction with fixation of the tumor to the abdominal parietes, a one-stage resection of the right colon is preferable. In the one-stage procedure, resection of the right colon, followed by an end-to-side ileotransverse colostomy, is done as a preliminary procedure; later the right colon is removed.

Lesions of the transverse colon, the splenic flexure, descending colon, and sigmoid are treated by resection with end-to-end anastomosis or by obstructive resection. The primary suture with end-to-end anastomosis, performed preferably with use of the aseptic technique, is better than obstructive resection because of the shorter convalescence, and also the more complete removal of the bowel and its mesentery. In 42 of the authors' patients, an end-to-end anastomosis with colonic resection was done in 27 (64.4%) and an obstructive resection in 15 (35.5%). Of the resections with end-to-end anastomosis, an aseptic technique was used in 17 and an open anastomosis in 10.

Although the authors resect and re-establish the continuity of the bowel in sigmoidal lesions with the exception of those at or near the rectosigmoidal junction, they believe that this procedure is not justified in the low-lying lesions. They have used it in only one patient in whom a primary anastomosis was done for a rectosigmoidal lesion. Fortunately, it was the first case in which the conservative procedure was done, and although it is believed that a fatality occurred unnecessarily in this case, it is the authors' opinion that had an abdominoperineal resection been done originally, the man would probably have been cured. The care of the colostomy, necessitating the taking of an enema every 2 or 3 days, is a relatively cheap price to pay for the cure of a malignant disease, as contrasted with the price of a few months' to a year's normal sphincteric control to be paid for with one's life.

Wide resection of the mesentery and the lymph-bearing area is essential. High ligation of the superior hemorrhoidal vessels and removal of the accompanying lymph nodes is necessary in rectosigmoidal and rectal lesions.

In 103 of the authors' cases, the tumor was graded according to Broder's classification; grade I, 12.6 per cent; grade II, 51.4 per cent; grade III, 38.8 per cent; grade IV, 1.9 per cent.

In the entire group of 113 cases, 96 resections were done (84.8%); 105 (92.8%) left the hospital alive, whereas 8 (7.1%) died in the hospital. The mortality rate following operation for cancer of the colon varies according to the location of the tumor. In 18 cases in which the right colon was removed for carcinoma, there were no fatalities. In 30 cases in which a portion of the left colon was resected (in 4 cases as a palliative procedure and in 26 as a curative procedure), there were 2 deaths (6.6%). In 48 cases in which rectosigmoidal resection was done, usually as an abdominoperineal resection (in 5 as a palliative procedure in spite of metastasis of the liver), there were 2 deaths (4.1%). Although there may be some question about the advisability of a palliative resection in malignant lesions of the colon and other viscera, this procedure seems perfectly justifiable to us, because not only is the patient relieved of the undesirable symptoms incident to an ulcerating tumor of the bowel, but following the removal of a primary tumor, the growth of metastatic lesions is less rapid than before the extripation of the original tumor.

In the authors' series of cases the resectability of lesions in the right colon and those of the rectosigmoid were approximately the same, 81.8 per cent and 84.3 per cent, respectively. The resectability of lesions of the left colon, exclusive of the rectosigmoid and rectum, was 65 per cent, due to the fact that in this group, extension to the abdominal parietes was present in a much higher incidence, which many times precluded resectability.

Although re-establishment of the continuity of the bowel in low-lying lesions has become a popular procedure, the authors believe that in any lesion except the extremely small ones in which there can be no extension distally, abdominoperineal resection is the operation of choice, and that as long as attempts are made to preserve the sphincter, the recurrence rate and death rate from carcinoma will continue to be high.

LEE PULLEN, M.D.

D'Allaines, F., and De Vernejoul, R.: Conservation of Sphincter Function in the Operative Treatment of Rectal Carcinoma (Conservation de la fonction sphinctérienne dans la cure opératoire du cancer du rectum). *J. chir.*, Par., 1946, 62: 274.

In rectal carcinoma one of two operations can be done: either the mutilating amputation, or resection of the rectum with conservation of the sphincters. A considerable number of surgeons reject the resection because of the supposedly greater risk of recurrence. However, the recent work on the anatomy of the lymphatics makes it possible, in appropriate cases, to conserve the sphincter without increased danger of metastases or recurrence. Of equal importance is an exact knowledge of the anatomy of the nerves of the sphincteric apparatus.

Although the resection is by far preferable to the amputation, it is applicable only under certain conditions. The resection should be as extensive as possible, at least 15 cm. above the superior border of the tumor and at least 5 cm. below the inferior border. As a certain portion of the anal canal should be left intact to assure a good functional effect, the operation is possible only if the inferior border of the tumor is at least 9 or 10 cm. distant from the anus. It is important to save not only the sphincter muscle and its nerves but the mucous membrane, if possible, to an extent of at least 4 cm. as the mucosa possesses a specific sensibility indispensable for the mechanism of continence. Only if the resection has to be done rather close to the sphincter must the mucosa be sacrificed (technique of Hochenegg, modified by Babcock and Bacon).

Another point of great importance is the radical ablation of the lymphatics. The recent literature on the invasion of the lymphatics in rectal carcinoma indicates that they have to be examined and removed, often as far as the inferior mesenteric trunk.

The authors discuss the different methods of conservative operation: abdominal, transsacral, coccygoperineal, transanal, and transvaginal resection. In the transanal and coccygoperineal methods it is essential to conserve the motor nerves of the external sphincter, at least on one side. A number of statistical papers are quoted to show that resection gives better results than amputation of the rectum, not only functionally but also with regard to the postoperative mortality and the incidence of recurrence and metastases. WERNER M. SOLMITZ, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Rehfuss, M. E.: The Etiology of Cholecystitis. *Gastroenterology*, 1946, 7: 665.

Biliary tract disease is now known to be the most common form of digestive disturbance affecting the upper abdomen in later life; as many as one-half of the individuals over 50 years of age are afflicted. There is no unanimity of opinion as to the cardinal factors in the production of biliary tract disease or the mechanism by which they operate. Only by correlating a large number of careful preoperative studies with anatomic and histologic examinations of the organ can we hope to reach more exact conclusions.

Clinical and experimental observations have supported the possibility of several active factors in the etiology of cholecystitis. These are infection, alteration of the gall bladder contents (particularly the bile salts), reflux of the pancreatic juice, lesions of the cystic duct (probably secondary), dissemination of bacteria and their toxins through lymphatic, arterial, or venous channels, and sensitization.

The author briefly cites the evidence for and against each of these factors and reviews the literature pertaining to each one.

The author then describes his work on producing experimental cholecystitis by injecting bacteria. He has demonstrated that every form of human cholecystitis can be obtained by experiments in which bacteria are injected. Histological studies of the experimentally diseased gall bladders show that any or all layers of the wall can be affected; the mucosa and submucosa seem most vulnerable while the muscularis seems to be the least vulnerable. This is true in human cholecystitis. Originally, the author was able to produce experimental cholecystitis in only 22 per cent of his series, but later, by altering his technique and giving more frequent inoculations over longer periods, he increased the incidence to 68 per cent. In about 10 years of experimentation he has observed the effects of a single antigen, the nonhemolytic streptococcus, in nearly 700 animals.

It appears that cholecystitis can follow a transient bacterial infection and that subsequent changes emphasize the fact that structural damage of various grades may follow relatively few inoculations. A chronic lesion may result from a single injection if its effect is sufficiently severe. It has been the author's experience that repeated injections over months have resulted in a marked increase in the chronic lesions. If the injections are stopped the lesions may be arrested.

Bacterial infection would seem to be the most likely condition capable of inducing an acute change with tissue destruction in a gall bladder in the absence of calculi. There is no indication that any particular strain of bacteria is to be incriminated in the production of cholecystitis.

In experimental cholecystitis, the antigen is not specific for the gall bladder but may produce lesions in the joints and some of the viscera. The evidence indicates that the bacteria or their toxins may localize in any or all parts of the biliary tract. The author is unable to state the nature of the action, whether it is a protoplasmic poisoning, necrosis of the cells, a profound disturbance in cellular chemistry, or enzymic activity.

Therapy of any kind should be directed toward the arrest of the acute lesion and control of the contributing factors by combating infection, regulating the metabolic mechanism, correcting biliary stasis, and preventing additional changes which might fur-

ther damage the organ. If these measures fail, we then have recourse to surgery.

The dietary approach is of primary importance in therapy, since by reducing the amount of fat in the diet one decreases the demands on the organ during inflammation and infection. Detection of the injurious agent, such as infection, toxin, or allergy, and its control are important. The author is convinced that many of the systemic infections, virus diseases, and local foci in sinuses and tonsils are important. If these are restrained general systemic resistance is encouraged. Penicillin and sulfonamides aid in controlling acute biliary infections. Carefully supervised vaccine, filtrate, and other forms of bacterial therapy should be considered. Many measures to modify the bile entering the gall bladder can be employed. To combat stasis the bile should be fluidified.

The author believes that cholecystitis may be an acute process, but it is more likely to be due to mild repeated infections acting slowly upon different parts of the gall bladder wall. Such changes may bring about or favor undue concentration of certain elements of bile or produce a pancreatic reflux. It is also possible that bacterial sensitization may play a role. ROBERT R. BIGELOW, M.D.

Elman, R.: Surgery in Acute Pancreatitis. *Gastroenterology*, 1946, 7: 656.

Because of the confusion existing in the minds of most clinicians as to whether acute pancreatitis should be treated medically or surgically, the author has prepared this article. He defines acute pancreatitis as a primary inflammation of the pancreas sometimes associated with biliary disease, but not the type secondary to mumps, diabetes, arteriosclerosis, nephritis, or alcoholism. The disease usually has an acute stormy onset with severe abdominal pain in an otherwise healthy individual.

In reviewing the literature on acute pancreatitis the author recognizes three distinct periods. In the early period, before 1900, practically all cases were observed at autopsy. Only one type of disease, hemorrhagic pancreatitis, was recognized before death, and the pathological changes were classically described by Reginald Fitz in 1889. In the second period, the early decades of the present century, the disease was encountered at operation, often performed without a definite diagnosis. There was a high mortality (50%), and as time went on the trend was toward more conservative treatment. The third period began 10 or 15 years ago, when medical treatment was given in view of the high operative mortality.

Much of the confusion in the literature is probably the result of the existence of at least two types of the disease, each strikingly different. Zoeppfel, in 1922, first described a type of acute pancreatitis, not necessarily fatal and not accompanied by necrosis or hemorrhage. The author believes this was an early stage in the development of true pancreatic necrosis which for some reason was aborted. The findings at operation were confirmed by many later surgeons, and it became obvious that the mortality varied greatly and depended on the type of pancreatic lesion present.

The uncertainty in making a bedside diagnosis of acute pancreatitis has led to difficulty in evaluating results of therapy. It was not until 1929 that the diagnostic use of the serum amylase test established the diagnosis of pancreatitis and tended to clear some of the confusion. It then became clear that many patients with acute abdominal symptoms which subsided rapidly and spontaneously actually suffered from pancreatitis as described by Zoeppfel. Unfortunately the serum amylase test will not differentiate between the two types of acute pancreatitis mentioned. More accurate data are necessary in order to evaluate the effectiveness of conservative as against operative therapy.

The author reviews his experiences with 17 cases of pancreatic necrosis, as shown at autopsy or operation. Of his patients only 1 survived, and this patient was operated on. Seven patients entered the hospital with profound circulatory failure and died soon afterward. It was doubtful if any form of therapy would have been successful in this group of patients.

Elman recommends routine serum amylase determinations of all patients with acute abdominal disease. The test takes a little over 30 minutes and shows high values in all patients with acute pancreatitis unless the patient has been sick for many days. Acute parotitis will also give high values. The problem of differentiating acute pancreatic edema from necrosis is not easy. About 80 per cent or more of the cases will prove to be of the interstitial or edematous type or occasionally of the subacute type and such conditions may be expected to subside spontaneously.

The necrosing type may show three clinical features: (1) the appearance of true circulatory impairment or shock, (2) the tendency for manifestations to be those of a spreading perforative peritonitis, and (3) the failure of the pancreatic necrosis to subside.

In suspected cases of necrosis, operation should be seriously considered, unless, of course, conservative therapy is less likely to be followed by a fatal outcome. There is slight evidence that suppurative pancreatitis has occasionally healed without operation, but it seems justifiable to assume that extensive necrosis of the pancreas should be looked upon as a perforating lesion leading to suppuration or spreading peritonitis. As such, it inevitably would require surgery even if only for drainage of the site of perforation, the lesser peritoneal sac.

Operation to be adequate must provide satisfactory drainage of the pancreas. It is doubtful if any incision into the organ is justified. There is evidence that cholecystostomy diverting bile from the common duct to the outside may be useful. Extensive procedures such as cholecystectomy or common duct drainage prolong the operation and increase the mortality. Operation should be associated with

nonoperative treatment such as gastric suction, both blood and plasma transfusions, and chemotherapy.

The view that acute pancreatitis is universally a nonoperative disease should be abandoned. Operation probably is not indicated in a vast majority of cases. Once the diagnosis is made by the aid of the serum amylase determination, each case should be carefully evaluated. Those obviously subsiding present no problem. Should the acute manifestations not subside, even though the serum amylase falls, the patient may be suffering from pancreatic necrosis and may require operative drainage of the lesser peritoneal sac. Even patients admitted in profound circulatory shock must be considered as possible candidates for surgical therapy. Just when operation is to be performed cannot be categorically stated, but when pancreatic necrosis is present, operation must be considered to avoid death if possible.

Pancreatic necrosis is to be differentiated from acute edematous pancreatitis and indicates actual destruction, usually with hemorrhage into, and gangrene of, the pancreatic parenchyma. Fat necrosis may be seen with both types but when this is extensive and involves the greater omentum it is nearly always associated with a true necrosis of the pancreas.

The answer as to whether acute pancreatitis requires surgical or medical treatment must be based on the differentiation between acute pancreatic edema and necrosis. This can be decided only by a careful study of the patient's clinical progress.

ROBERT R. BIGELOW, M.D.

Whipple, A. O.: Radical Surgery for Certain Cases of Pancreatic Fibrosis Associated with Calcareous Deposits. *Ann. Surg.*, 1946, 124: 991.

The author records 2 total pancreatectomies and 3 other radical procedures with the removal of a large part of the organ for intolerable pain associated with pancreatic fibrosis and calcareous deposits and pancreatic calculi. A history of acute pancreatitis or of chronic alcoholism is common. Disturbed carbohydrate metabolism in the form of mild diabetes is found in about a third of the cases. The same is true of abnormal fat digestion and abnormal stools. Mild pain in the epigastrium is present in the majority of the patients. In some patients the pain is so severe and constant, frequently radiating through to the back, as to be intolerable.

The most important laboratory examination is a plain film of the upper abdomen to demonstrate the presence and extent of the calcareous deposits which may appear in the head, the body, or the tail of the pancreas: or the entire organ may be outlined by the calcareous material. Next in importance is the finding of a marked deficiency in one or more of the pancreatic ferments, as determined from duodenal aspirations with the administration of metholyl chloride.

The extent of removal of pancreatic tissue in these radical procedures is determined by the part of the organ showing the calcareous material, as seen in roentgenograms, and the amount of fibrosed tissue.

The author states that all of these patients require transfusion therapy during and after operations. The close co-operation of an internist experienced in the treatment of diabetes before and after operation is essential.

EMIL C. ROBITSHEK, M.D.

GYNECOLOGY

UTERUS

Figarella, J.: Surgical Treatment of Prolapse of the Uterus (Le traitement chirurgical du prolapsus utérin). *Gyn. obst.*, Par., 1946, 45: 110.

In many cases the operation for prolapse of the uterus gives good results in the beginning, but recurrences take place after a few years. The author discusses a series of 77 cases in which prolapse recurred after surgery had been done with good primary results.

One cause of recurrence is incomplete operation. There are three lesions involved in a prolapse: descent of the uterus, cystocele, and relaxation of the perineum. The descent should be corrected by a fixation of the uterus to the anterior abdominal wall, the cystocele by anterior colporrhaphy, and the perineal relaxation by posterior colpoperineorrhaphy. All three operations should be done in every case.

The second cause of recurrence is a lesion complicating the prolapse. The most important lesions are hypertrophic elongation of the cervix, endometritis, and tumors of the uterus.

Finally, faulty technique or poor preoperative and postoperative care may be responsible for recurrences.

The choice of the kind of operation to be done (Schauta-Wertheim, Le Fort, Halban, Bouilly) depends on the age and on the kind of lesion in the individual case. Patients with hypertrophic elongation of the cervix should be treated by the Bouilly operation.

WERNER M. SOLMITZ, M.D.

Gleadell, L. W.: The Surgical Treatment of Myomas of the Uterus, with Particular Reference to Myomectomy. *Austral. N. Zealand J. Surg.*, 1946, 16: 30.

The present report concerns the experience of the author in the surgical treatment of 376 patients with uterine myomas, of whom 66 were subjected to myomectomy.

The indications for surgical treatment were as follows: (1) size of tumor—the patient is operated upon if the abdominal enlargement causes embarrassment; (2) rapid increase in the size of the tumor; (3) pain and bleeding after the menopause; (4) secondary anemia; (5) certain cases of sterility.

Factors influencing the selection of cases for myomectomy were:

1. Age of the patient. In many instances the length of time the patient had been married and her desire for children were considered more important than age.

2. The number of tumors. The fewer the number, the more acceptable is the patient for myomectomy.

3. The situation and size of the tumors. The site, except for central cervical tumors, does not matter.

4. Pregnancy. Interference is rarely indicated during pregnancy. Cesarean hysterectomy is a safer procedure than cesarean section and myomectomy.

Factors which are believed to be unfavorable to myomectomy are:

1. Adnexal pathology. Cystic ovaries may be resected and neoplasms removed at the time of myomectomy, but tubal plastic procedures are contraindicated.

2. Suspicion of malignant disease.

With regard to operative technique, the author states that careful asepsis is important; the vagina is prepared with zephiran, 1 to 400, and Bonney's blue is injected into the uterine cavity. Absorbable sutures are preferred and the dead space must be completely obliterated. An anterior incision is preferable because it can be peritonealized more completely. The uterine cavity may be opened to reach tumors of the posterior wall unless they are subperitoneal in location, in which event a posterior incision may be made. The vesicouterine fold may be used to cover the anterior incision, or the round ligament may be sutured over it. The posterior incision may be covered by the round ligament, the pelvic colon, or the mesosalpinx.

The results of myomectomy were as follows:

Of 21 patients who had complained of menorrhagia, 18 were cured; of 15 patients who had been sterile and who tried to become pregnant after operation, 9 conceived; patients with abdominal swelling were relieved; of 14 patients who had complained of pain, 12 were relieved; of 10 patients with dysmenorrhea, 6 reported improvement; 2 of 4 patients who had had repeated miscarriages were delivered of full term infants; and 1 patient was relieved of dyspareunia.

Three of the 66 patients (4.5%) who were subjected to myomectomy developed symptoms requiring further surgery. There were no deaths. Fifteen patients had febrile postoperative courses due to chest complications, wound infection, intestinal obstruction, or bladder injury.

J. ROBERT WILLSON, M.D.

Cusmano, L.: Clinical and Statistical Notes on Cancer of the Cervix of the Uterus (Note clinico-statistiche sul cancro del collo dell'utero). *Ginecologia*, Tor., 1946, 12: 249.

During the past 12 years, from 1933 to 1944, inclusive, 7,666 gynecological cases have been admitted to the author's clinic at the University of Parma. Of these, 367, or 4.77 per cent, were carcinomas of some part of the uterus and 281, or 3.66 per cent, were cancers of the cervix. Details are given in regard to the disease, the age of the patient, the number of childbirths she has had, her civil status, and her hereditary tendencies. The cases are then divided into three groups: those treated surgically (85 or 30.24 per cent); those treated first with

radium therapy (125 or 44.42 per cent); those treated first with roentgen therapy (59 or 20.99 per cent); and those treated only medically (12 or 4.27 per cent).

Tables are given showing the immediate and late results in all of these cases.

Among the 85 cases treated surgically by Wertheim's amplified hysterectomy there was an immediate mortality of 7, or 8.2 per cent. The results were followed up to 5 years after operation in 39 cases, and among these there was absolute cure in 19, or 48.71 per cent; in 4 there was death from the operation, and in 16 death within 5 years after operation, but among the latter, death occurred from intercurrent disease in 4 and from recurrence in 12; therefore, the mortality from the latter cause was 30.76 per cent.

Among the 125 cases treated with radium there was death immediately after the operation in 5, or 4 per cent. Among the 48 cases followed up for 5 years there was cure in 16, or 33.3 per cent, while the remaining 32 patients died within 3 years of operation.

These statistics indicate that changes should be made in the usual method of treating cancer of the uterus; radiotherapy should be given in beginning cases of cancer and those still limited to the uterus, and radiotherapy should precede surgical treatment even in the more advanced cases.

AUDREY G. MORGAN, M.D.

Scartozzi, C.: On the Treatment of Cancer of the Cervix (Sul trattamento del cancro del collo dell' utero). *Minerva med.*, Tor., 1946, 37: 369.

Five hundred cases of cancer of the cervix observed at the Institute of Surgical Pathology of the University of Torino are reported by Scartozzi. Only operable cases were included in the series, inoperable ones being referred for irradiation treatment. All patients were thoroughly examined prior to surgery in order to determine accurately the extent of the lesion. The operation performed was the classical Wertheim. Postoperative irradiation of the pelvis was found to be of value, and therefore was regularly practiced.

Conditions did not permit follow-up studies. It can be stated, however, that the prime mortality was extremely low and that many patients were known to be in good health 7, 8, 9, and even 20 years after the surgical intervention.

EDITH B. FARNSWORTH, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Bianchi, P.: The Significance of the Microcystic Ovary in the Fetus (Sul significato dell'ovaio microcistico fetale). *Riv. ital. gin.*, 1945, 28: 301.

The histopathological findings of a fetus at term are described with particular respect to the ovaries which were approximately twice the normal size and contained follicles and follicular cysts. A precocious differentiation was also noted in the cellular elements of the hypophysis. Basing his discussion upon these observations as well as upon accepted concepts of the humoral relationship between the hypophysis and ovary, the author proposes the following hypothesis:

1. There exist in the neonatal ovary possibilities of follicular maturation characterized by a certain maximum point.

2. That maturation may proceed so far as to approximate a pseudolutein phase without showing migratory movement of the follicle toward the surface of the ovary.

3. Microcystic degeneration is an involutionary process characteristic of such abnormally developed follicles, the end-result of which is atresia.

4. This anomalous behavior of the ovary is secondary to an augmented activity on the part of the anterior lobe of the hypophysis.

5. This sequence of events is in turn the probable result of a functional deficiency of the placenta which gives rise to maternal and fetal compensatory actions.

EDITH B. FARNSWORTH, M.D.

Niosi-Cusimano, G.: Postclimacteric Metrorrhagia and Malignant Tumors of the Ovary (Metrorragie postclimateriche e tumori maligni dell'ovaio). *Riv. ital. gin.*, 1945, 28: 264.

Three cases of metrorrhagia resulting from a malignant tumor of the ovary are reported. In all 3 the histological diagnosis was adenocarcinoma with hyperplasia of the endometrium. The author reviews the course of opinion concerning the pathogenesis of endometrial hyperplasia and hypertrophy, and corroborates the theory that they are the result of the production of folliculin in irregular quantity and rhythm. Such production is postulated as being stimulated directly or indirectly by the attacked ovary.

The precocious appearance in the cases reported of postclimacteric bleeding, before the presence of an ovarian tumor could be clinically determined, is emphasized, and the recommendation is made that metrorrhagia be considered as a potentially malignant sign until all necessary measures be taken to establish the underlying cause. As a reliable routine, the author suggests diagnostic curettage to exclude early evidence of malignant degeneration in the endometrial tissue, with fortnightly pelvic examinations to determine any increase in the size of the ovaries and prompt exploratory laparotomy on the earliest indications. EDITH B. FARNSWORTH, M.D.

Vara, P.: Connective Tissue Tumors of the Ovary (Ueber Bindegewebsgeschwuelste des Eierstocks). *Ann. chir. gyn. fenn.*, 1946, 35: 112.

Among 688 cases of tumors of the ovary, the author found connective tissue tumors (fibromas and sarcomas) in 36 cases. Frequently it is difficult to differentiate these neoplasms from granulosa cell tumors. The tumors occurred at all ages, before as well as after the menopause: they were nearly always unilateral, and their size varied from that of a pigeon's egg to that of a man's head. Thirty were fibromas and 6 sarcomas. They never caused any hormonal disturbances. Ascites occurred in 17 per

cent of the fibromas and in 33 per cent of the sarcomas. Adhesions were rare in the fibromas, but rather frequent in the sarcomas. The prognosis was good, even in the sarcomas. All of the patients were free from symptoms 5 years after the operation.

WERNER M. SOLMITZ, M.D.

Nobili, L.: Neoplasms of the Broad Ligament: A Critical Review of the Literature with a Report of 3 Cases (Le neoplasie del legamento largo. Rivista sintetico-critica con contributo personale di tre casi). *Riv. ital. gin.*, 1945, 28: 312.

Three cases of primary sarcoma of the broad ligament are reported. A review of the literature brought to light 21 adequately documented cases of such tumors originating in the broad ligament, to which Nobili adds his 3 under the histopathological diagnosis of (1) polymorphosis fibromyxosarcoma, (2) fibroreticulosarcoma, and (3) fibrosarcoma respectively. These neoplasms occur more frequently in individuals between the ages of 30 and 50. Their form is ordinarily round or oval, and their surface smooth or finely nodular. Their consistency is that of dense elastic tissue and their weight may reach 11.3 kgm. The varieties of sarcoma in order of frequency are: pure sarcoma, fibrosarcoma, chondrosarcoma, sarcomatoid myoma, telangiectatic sarcoma, pseudocystic myoma with fibromyosarcomatous degeneration, and fibroreticulosarcoma. Metastases were found in 30.4 per cent of the cases, but no characteristic site of the metastases was indicated. The symptomatology of these tumors is ill defined and the diagnosis is made on pelvic examination.

Although these tumors are highly malignant, histologically, the clinical course appears to be somewhat more benign, and the cases which constituted the 30 per cent mortality rate were those in which surgery was undertaken at such a time when the large size of the tumors and the presence of adhesions presented special mechanical difficulties.

EDITH B. FARNSWORTH, M.D.

MISCELLANEOUS

Collins, C. G., and Nelson, E. W.: Phlebothrombosis and Thrombophlebitis in Gynecology and Obstetrics. *Am. J. Obst.*, 1946, 52: 946.

To emphasize their full importance, the complications arising from intravascular clotting in gynecologic and obstetric practice have been reviewed by the authors. A study of the records of all deaths, and of autopsy records when autopsy was obtained, showed that intravenous clotting was present in 50 of the 536 deaths from all causes, exclusive of abortion, that occurred in 32,198 admissions to the gynecologic service at Charity Hospital in New Orleans during the period from July 1, 1939 to January 1, 1946.

The authors maintain that by simple preoperative and postoperative measures, the incidence of intravascular clotting, either aseptic or septic, can be lowered and in this way a number of deaths and disabling and disfiguring sequelae can be prevented The routine postoperative or postpartal examination of the patient's legs is as important as examination of the abdomen. No complaint of thoracic pain, pain in the leg, or swelling of the leg should be casually dismissed.

Patients with pelvic tumors and unilateral or bilateral edema of the legs should be considered as having phlebothrombosis of the deep veins of the extremity or pelvis until otherwise proved. One should be careful about ascribing the edema or swelling to pressure produced by the growing tumor. In all cases in which phlebothrombosis or thrombophlebitis is found to be the etiologic factor, adequate therapeutic measures should be instituted prior to surgical attack on the abdominal tumor.

In patients with suppurative pelvic thrombophlebitis failing to respond to conservative measures, and especially those in whom infection has occurred, surgical therapy should be instituted. If surgical therapy is undertaken, the return flow of the blood from the uterus should be ligated, i.e., the vena cava and both ovarian veins should be ligated. This ligation will save a number of lives and the complications (if any) following this procedure are slight. Following ligation of the vena cava, the risk of postoperative complications may be minimized if the patient is given routine postoperative lumbar sympathetic blocks, or if the sympathetic lumbar chain is interrupted at the time of operation.

JOHN R. WOLFF, M.D.

Burns, E., and Butt, A. J.: The Significance of Chronic Urethritis in Women. *South. Surgeon*, 1946, 12: 352.

An analysis of 100 cases of chronic urethritis in women is presented. Carelessness in vulvar hygiene, endocervicitis, pyelonephritis, radium application, sexual trauma, catheterization, and the presence of a rudimentary prostate as described by Folsom may be predisposing factors.

The chief symptoms are those of bladder irritation and pain. The mucosa of the posterior third of the urethra and the vesical trigone present an irregular, red, granular appearance. Congestion of the blood vessels, small cysts, and inflammatory polyps may be present. The urinalysis generally yields negative findings.

The disease can be cured within 6 or 8 weeks by irrigation of the bladder, dilatation of the urethra with sounds, and the instillation of silver nitrate solutions into the posterior urethra.

GEORGE BLINICK, M.D.

Keller, R.: Appendicitis and Sterility (Appendicite et stérilite). *Rev. fr. gyn. obst.*, 1946, 41: 201.

It is not uncommon during gynecological operations to see the effects of an old, heretofore unsuspected case of appendicitis. In thoroughly reviewing the patient's history, a syndrome can sometimes be elicited which, in retrospect, can be considered an appendicitis with a clinical course which has been in-

sidious. Then, at the level of the internal genital organs, one can notice the presence of adhesions, especially in the right side of the pelvis.

It is not surprising that acute appendicitis, particularly the perforated type requiring drainage, can produce adhesions in the immediate vicinity, especially at the level of the uterine tubes. The same local reactions can also take place following an attack of appendicitis that has occurred prior to the marriage state and which has given but very mild symptoms.

Various parts of the internal female genitalia may participate in the process of appendicitis; but the lesions involving the tubes themselves are particularly liable to impair their function and have the most detrimental effects on fecundation. The uterus and the ovaries may also be involved and be the seat of changes so important that they may constitute the only cause of sterility. Sometimes the sterility is the result of various influences which differ in their degree of participation.

In order that fertilization can take place, one of the essential factors is the patency of at least one of the tubes, and it is precisely the patency of the tubes that may be impaired following appendicitis. The presence of adhesions can either produce a kink in the tube or exert a pressure on its outer surface. In both instances, the final result is the same—partial or total obliteration of the lumen of the tube. It is understandable that such adhesions can take place following an appendectomy for a severe form of acute appendicitis, especially if drainage has been instituted. Nevertheless, the formation of adhesions should not always be attributed to the establishment of drainage. It may follow any acute inflammatory process which has healed spontaneously without operation.

The adhesions may develop at the abdominal orifice of the tube which may become partially or totally closed. These adhesions may subside, disappear, and leave a patent tube. Nevertheless, following such an inflammatory process, the tubal wall will lose some of its contractile power, which interferes with the progression of the fertilized egg toward the uterine cavity. In these instances, salpingography reveals the perfect patency of the tubes and yet the woman is sterile.

It is not exceptional for the appendicular infection to reach the lumen of the tube where it produces the known effects of endosalpingitis, which finally leads to the welding of the mucosal folds and sometimes to complete obliteration of the lumen of the tubes with the formation of blind recesses, true traps in which the fertilized egg can be immobilized.

A certain number of tubal pregnancies must be found in those anatomical disorders of the lumen of the tube secondary to a colibacillary infection, the primary focus of which is the appendix.

Needless to say, the closer the appendix is to the tubes, the more often one will see the dissemination of the appendicular infection to the tubes.

The infection spreads from the appendix to the tube either by direct continuity or through the lymphatics. Direct contamination is almost fatal when the tube is very close to the infected appendix. It occurs early after the manifestation of the infection in the appendix. Infection by way of the lymphatics may occur late. The latter mode of spread explains why the salpingitis following the appendicitis is sometimes bilateral. On the other hand, the infection may spread from the right to the left side through the uterine mucosa.

Often the ovaries are involved by the infectious process originating in the appendix. The hyperemia associated with the infection produces a permanent congestion of the ovary and finally a sclerocystic oophoritis. Oligomenorrhea and even amenorrhea have been reported to occur following appendicitis.

Appendicitis rarely exerts a direct influence on the uterus as far as sterility is concerned. A retroverted uterus fixed in the pelvis by adhesions is often the cause of sterility.

The charts of 213 patients admitted to the hospital for sterility between 1935 and 1945 were reviewed: 194, or 91 per cent, were classified as having primary sterility and 19, or 9 per cent, as having secondary sterility.

Among these 213 patients, 123 were sterile without having had appendicitis, and 90, or 42 per cent, had had appendicitis. In 52 instances it consisted of a simple acute appendicitis which was operated on early under satisfactory conditions without postoperative complications; in 38 instances it consisted of a severe acute appendicitis with peritonitis requiring drainage.

Only 3 of these 90 women underwent appendectomy in childhood. Thus, it seems that the appendicitis exerts greater influence on the genital organs of the adult than on those of the child.

If the existence of an old appendicitis can be elicited in the history of these 90 sterile women, one is not yet justified in concluding that the appendicitis is the cause of the sterility. In fact, after a careful study of the charts of these 90 patients, it was found that in only 34 patients could the appendicitis be incriminated as the cause of the sterility. Of the 34, 15 had had simple appendicitis and 19 had had a severe, complicated type.

In 56 patients the appendicitis was considered as a coexisting condition and not as the cause of the sterility.

From these studies, the incidence of sterility following appendicitis is 16 per cent.

GERARD GAGNON, M.D.

Matteace, F.: Hemoperitoneum from Ectopic Chorioepithelioma (Emoperitoneo da corioepitelioma ectopico). *Clin. ostet.*, 1946, 48: 180.

The author reports the case of a young woman of 25 years, a primipara, who spontaneously delivered a vesicular mole in the fourth month of pregnancy without having had the usual clinical symptoms of this condition. The puerperium was uneventful. However, during the next 15 months she had a series of hemorrhages at varying intervals without any

great impairment of her general condition. Surgical exploration did not show any tumor of the uterus or ovaries. The Friedmann reaction was definitely, but not intensely, positive during the whole course of the illness. Suddenly at the end of that period she had a copious retroperitoneal hemorrhage with infiltration of the retroperitoneal tissues from the left iliac fossa to the kidney bed on that side. Postmortem examination showed a small tumor on the sacroiliac wing situated near the bifurcation of the common iliac artery.

There was some question as to whether this tumor was a sarcoma or a chorioepithelioma, but after careful weighing of the evidence the author decided in favor of the latter. The confusion is not surprising as there is a close relationship between these two forms of tumor. There were nodules in the lung which the author believes were metastases, although the histological evidence was not absolutely conclusive.

The only possible method of treatment in cases of primary ectopic chorioepithelioma of which the site cannot be discovered is medical, the disintegrated chorionic villi being prepared by the method of Sivor and Rebaudi. This method of treatment was first used successfully in 1937.

AUDREY G. MORGAN, M.D.

De Giorgi, L.: The Relation of Tumors of the Small Bowel to the Genital Organs in the Female (I tumori del tenue nei rapporti con gli organi della sfera genitale femminile). *Arch. ostet. gin.*, 1942, 6:27.

The author reports a case of leiomyoma of the ileum with multiple secondary nodules in which the sarcomatoid structure and cellular polymorphism confirmed the clinical impression of malignancy. Although relatively undifferentiated myoblasts were found, it is suggested that the genetic interpretation be evaded and the tumor be defined as an "atypical, immature leiomyoma," a term which indicates the degree of differentiation as well as the cytological character of the neoplasm. This choice of term arises from the fact that although the degree of dedifferentiation is often directly related to the degree of malignancy, a high grade of malignancy is sometimes found to be associated with a rather strictly adult type of cell, and in certain other cases the tumor clearly stems not from the myoblastic but from the mesenchymal elements.

In the case reported, a history of irregular menses, frequent and painful urination, a low grade elevation of temperature, and a tumor mass in the right iliac fossa led to a discussion of the differential diagnosis between tumors of the pelvis and those of the small bowel.

EDITH B. FARNSWORTH, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Josephy, H., and Hirsch, E. F.: Eclampsia. Report of a Case in Which There Was Extensive Destruction of the Brain. *Arch. Path.*, Chic., 1946, 42: 391.

The authors describe the pathological changes occurring in the brain of a woman who died 3 months after having eclamptic seizures. There is in the literature only one other recorded description of the brain of a patient who survived eclamptic seizures for any essential period—that of the brain of a woman dying 7 years after her illness, which showed widespread cortical degeneration and centrum ovale changes. This was reported by Lowenberg and Lossman in 1943.

The patient was a 15 year old primagravida who had had edema, albuminuria, and elevation of blood pressure beginning at the eighth month, and had experienced generalized convulsions almost continually during induced labor and delivery. Sodium amytal, given intravenously, was successful in eventually controlling the convulsions; however, there was a sharp fall in blood pressure at the time of delivery, and oxygen was necessary. The patient never regained mental consciousness, and led a vegetative existence for the next 3 months. On the eleventh postpartum day, generalized spasticity (i.e., decerebrate rigidity) appeared and persisted until death. A temperature elevation ranging from 101° to 104° was observed during this postpartum period, and a gradual increase in cerebrospinal fluid pressure was noted.

Essentials of the neuroanatomical diagnosis at autopsy were a marked encephalomalacia and atrophy of the cortex of the brain; other nonneurological findings were consistent with chronic illness. The brain with the upper half of the dura weighed 900 gm. The spinal fluid was abundant, clear, and colorless. The pia-arachnoid at the base of the brain was thin and transparent. The arteries at the base had thin walls. The tissues of the cerebellum, pons, and brain stem were firm, but those of the cerebral hemispheres were soft; the convolutions were atrophic and flattened, and the sulci narrowed. Convolutions were rounded and the sulci wider in the posterior portions of the parietal and occipital lobes. The dura and the accessory cranial sinuses were not unusual. After formaldehyde fixation the significant findings were softened cerebral hemispheres, a cerebral cortex narrowed and generally separated from the centrum ovale by a narrow layer of loose tissue parallel to the gyral surface (coronal sections), pale and friable white matter, dilatation of the lateral ventricles, normal basal ganglions, cerebellum, pons, and brain stem.

Histological examination (staining by van Gieson's method) disclosed thickened pia-arachnoid, veins dilated with occasional extravasations, poorly staining white matter in the parietal lobe and second and third temporal gyri in contrast to the darkly stained first temporal gyrus, thin temporal and parietal cortex, focal regions of demyelination in the frontal gyri, marked cortical destruction in the anterior portions of the cerebral hemispheres with marked loss of nerve cells and fibers, and mesenchymal growth along with glial proliferation, coagulation necrosis, cortical, capillary and venous dilatation, and mural thinning, and dilatation of the perivascular spaces with occasional small hemorrhages. In brief, observations disclosed advanced organization and scarification of cortical tissue and demyelination of the centrum ovale. Only minimal destructive changes were seen in the cerebellum.

Autopsy reports of brains of women who died during eclamptic seizures have shown, in general, more diffuse than focal changes. Edema, degeneration of ganglion cells, reaction of glia and meninges, and hemorrhages are the chief findings, all representing on a small scale what was observed by the authors in the form of diffuse damage. All circulation disturbances in the brain are generally thought to be functional rather than actually organic.

Whereas Lowenburg and Lossman assumed that the initial process in the genesis of the disease was necrosis of the nervous parenchyma caused either by functional circulatory disturbances or toxicity, the authors believe that a vascular genesis rather than a primary parenchymal degeneration is present. Softenings in cortex and white matter point to a disturbance in blood supply, as does glial proliferation without mesenchymal involvement, and also the enormous dilatation of capillaries and small veins adjacent to nerve changes.

In conclusion, the authors state that vasoparalysis, as well as venous and capillary thrombosis, is responsible for most of the lesions observed by them. Anoxemia may be a secondary factor, producing the diffuse demyelination observed in the region of the centrum ovale.

The authors conclude that probably central nervous system damage occurs following eclampsia more often than has been reported; occasional references have been found to psychoses persisting after eclampsia, but no systematic neuropsychiatric examinations on such patients have ever been done.

PHILIP B. CHASE, M.D.

Will, G.: Rupture of the Capsule in the Eclamptic Liver (Ruptura de la cápsula en hígado eclámptico). *Rev. obst. gin.*, 1946, 6: 102.

Rupture of the liver is generally brought about by external violence, but just as disastrous results may be caused in some cases by toxins, such as those of pregnancy, syphilis, malaria, typhoid fever, and tuberculous peritonitis.

A case of this type of rupture is described in a woman of 32, in the sixth month of her eighth pregnancy. The night before her admission to the hospital she had intense epigastric pain; as her blood pressure was very high the attending physician sent her to the hospital the next morning with a diagnosis of high blood pressure from pregnancy. She presented anuria, but no convulsions.

Soon after admission to the maternity hospital she collapsed. Her blood pressure fell to a very low level. She was given antitoxic serum and a blood transfusion. A diagnosis of rupture of the uterus was made and operation decided upon. On operation a large amount of blood was found in the abdominal cavity but the uterus was intact. The incision was enlarged upward and an enormous hematoma of the liver, 5 cm. in height, was found. The capsule had ruptured and the blood poured into the abdominal cavity. As ligation was impossible, a Mikulicz tampon was applied and the abdomen closed. The patient died a few hours later without having regained consciousness.

Autopsy confirmed the presence of a subcapsular hematoma over the whole upper surface of the right lobe. The capsule was ruptured. The liver parenchyma showed multiple recent focal hemorrhages and fatty degeneration. Histological examination revealed complete disintegration of the liver cells. There was also marked parenchymatous degeneration of the kidney cells.

The toxins of eclampsia may therefore have practically the same effect on the liver as external violence. AUDREY G. MORGAN, M.D.

Rochat, R. L.: The Etiology of Spontaneous Abortion—Excepting Syphilis (Étiologie de l'avortement spontané—en dehors de la syphilis). *Gyn. obst.*, Par., 1946, 45: 299.

This article gives a general report of our present knowledge regarding spontaneous abortion. Although in about 40 per cent of the cases of spontaneous abortion no definite cause can be established, modern research in histopathology, biochemistry, endocrinology, serology, and genetics has cast new light on the problem.

The belief that syphilis is the most frequent cause of abortion is erroneous. According to French, Italian, and Swiss statistics, not more than 2 per cent of abortions observed in hospitals are due to syphilis. The other etiologic factors can be classified according to whether the etiologic defect lies in the gametes, in an anomaly of the ovum and its adnexa, or in some general or local deficiency of the maternal organism. Factors which may cause weakness or defects of the sperm or ovum include old age, overexertion (sexual, physical, or intellectual), intoxications, infections, or unknown constitutional conditions (incompatibility of the partners).

Since, according to Williams, in abortions of the first trimester the death of the fetus almost always precedes the abortion, it is essential for the solution of the problem to find the cause for the death of the embryo. As a matter of fact, malformations of the embryo and anomalies of the placenta play an important role. In a series of 1,000 abortions, Hertig found abnormal ova in 48 per cent, localized fetal malformations in 3.2 per cent, and anomalies of the placenta in 9.6 per cent. Among the anomalies of the placenta, hydatidiform degeneration was the most frequent; arteritis obliterans of the villous vessels was seen frequently also. Furthermore, acute hydramnios often seems to be the cause of abortion.

Acute or chronic infectious diseases may be transmitted from the mother and cause death of the fetus. According to De Lee certain contagious diseases like scarlet fever and variola may be transmitted to the fetus, although the mother does not show any signs of infection. Also of great interest is the question whether focal infections of the mother (teeth, tonsils) may be transmitted to the fetus and cause abortion (Curtis).

Pathological conditions of the uterus causing abortion include endometritis, fibroids (especially the submucous form), retroflexion, and hypoplasia, whereas malformations seem of minor importance.

Diseases and deficiencies of the mother that may lead to abortion are acute infections like typhoid, smallpox, and measles, by way of fetal infection, intoxication, or hyperpyrexia. Of the chronic diseases, the various forms of nephropathies have been discussed the most. It seems, however, that only chronic hypertensive nephritis plays a certain role in repeated abortion. This occurs mostly in the second trimester and is usually caused by placental hemorrhages.

That diabetes has a most unfortunate influence on pregnancy is a well known fact. Before the insulin era, from 60 to 80 per cent of the cases resulted in abortion. Under insulin therapy, the percentage of abortion still is 25 per cent (White). The cause of the interruption seems to be acidosis.

Cardiac conditions seem to play a minor role, if any. The author reports in detail modern researches concerning vitamin deficiency as the cause of abortion. According to Hosemann, the vitamin C content of the placenta increases progressively during normal pregnancy, whereas the content in the circulating blood decreases proportionally. At the time of spontaneous abortion, the vitamin C in the placenta drops rapidly. Most probably, ascorbic acid is essential for the formation of progesterone in the corpus luteum. The need of vitamin C is tripled during pregnancy (from 70 to 100 mgm.). However, the author asks the following question: "If the role of vitamin C is really very essential in pregnancy, how can it be explained that the percentage of abortions and premature deliveries in the European countries did not increase during the war in view of the very low supply of vitamin C?"

As to the influence of vitamin E, a striking discrepancy exists between the experimental and clinical experiences. Rats fed with food deficient in vitamin E aborted on the thirteenth day of pregnancy, but this abortion could always be prevented by a

supply of vitamin E, natural or synthetic (tocopherol). The clinical experiences were not equally satisfactory. Whereas some authors published very encouraging results, others did not have any success. This apparent contradiction is easily explained if the vitamin E content of the blood is examined in every case. Success of vitamin E therapy can be expected only in cases of vitamin E deficiency. The vitamin E content of the blood should be above 400 gamma per cent (the average is 678 gamma per cent). All cases with a content below 400 should be subjected to treatment, and in these, success is obtained in almost 100 per cent.

Among the various hormonal deficiencies, that of progesterone plays the most important role in habitual abortion. In normal pregnancy, the amount of pregnandiol in the urine increases between the seventieth and ninetieth days. This increase is not observed in habitual abortion. Browne and his collaborators believe that in these cases there is a gap between the cessation of corpus luteum function and the beginning of intraplacental secretion. Many cases of failure following progesterone treatment may be due to insufficient frequency of the injections. Since progesterone is eliminated quickly, it should be given in a preparation of slow resorption (lutocycline) and continued for a long time. However, this treatment may lead to missed abortion if it is started after the death of the embryo.

As to estrogenic hormone, deficiency as well as excess secretion has been believed to be the cause of abortion. Insufficient secretion may lead to hypoplasia of the endometrium (infantilism) which endangers nidation.

The role of the anterior pituitary lobe is still undecided, however; experiments seem to indicate that its normal functioning is essential for the continuation of gestation. Whether hypothyroidism predisposes to habitual abortion, as some men believe, appears doubtful. In a series of 591 cases, the author did not observe a single case of hypothyroidism.

No definite evidence has been found pertaining to the Rh factor as a cause of habitual abortion.

It appears rational that the mechanism of isoimmunization may present a new etiologic element in habitual abortion, but the observations are still too incomplete to form a definite opinion. The influence of lethal genes may also have a bearing on habitual abortion. Although experiments on mice have proved definitely that the lethal gene is a fact, nothing is known as yet about its action in man.

WERNER M. SOLMITZ, M.D.

LABOR AND ITS COMPLICATIONS

Da Cunha, D. P.: Abdominal Cesarean Section (Cesarianas abdominais). *Rev. clin. inst. maternal*, 1946, 1: 17.

The author reviews the history of cesarean section and describes the details of various forms of the operation. He then discusses 168 cases which he has treated—15 by high or classical cesarean section, 129 by low section, 7 by the Portes operation, and 17 by cesarean operation accompanied or followed by hysterectomy. He believes that the low operation is to be preferred to the high one, as being less dangerous to both the mother and child. The lower segment of the uterine wall is much thinner than the upper one and does not contract during labor. The author's low operation is transperitoneal while that of Portes is extraperitoneal. There was infection in 83.4 per cent of the author's cases. The fetal mortality was 2.9 per cent. The total maternal mortality for the whole group was 5.95 per cent, but subtracting 2 cases in which the patients died from the anesthesia and one case of death due to heart failure 18 days after the operation, the real operative mortality was 4.1 per cent. The mortality in the low operation was 2.3 per cent and in the high operation 13.5 per cent. There were complications in 29 per cent of the cases, which incidence is lower than usual. Siegel reports from 36 to 58 per cent and Jauss reports 20 per cent of very severe complications.

AUDREY G. MORGAN, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Greenberg, E. M.: The Fourth Stage of Labor. *Am. J. Obst.*, 1946, 52: 746.

The sequence of intrauterine events which transpire during the postplacental hour comprises a distinct physiological and clinical entity. Their collective recognition as the "fourth stage of labor" would help save the lives of those mothers who die of mishandled postplacental hemorrhage, and spare the survivors the complications of sepsis and anemia that lie in its wake.

As the sulfonamides and antibiotics seal the doom of puerperal infection, puerperal hemorrhage will eventually take first place among the causes of maternal mortality; and as the attempts to combat puerperal hemorrhage gain in momentum, the critical first postplacental hour will necessarily have to be accepted as a normal part of every labor, for, as a series of individual but interrelated physiological components, the fourth stage of labor will have to be recognized and treated with understanding, lest one of its components rebel under maltreatment, and cause destruction.

The physiology of the fourth stage of labor consists of a contractile and a hemorrhagic phase. The contractile phase includes the stages of (a) "uterine myotamponade" or immediate uterine contraction; (b) "uterine thrombotamponade" or secondary relaxation with the formation of placental site sinusoidal and intrauterine hematomas; (c) "myouterine indifference," and (d) "fixed myouterine contraction." The hemorrhagic phase includes traumatic hemorrhage or uterovaginal tract bleeding, and atonic hemorrhage with a clotting hemorrhagic component associated with placental separation and a nonclotting hemorrhagic component probably arising from denuded myometrium. Both the contractile and hemorrhagic phases are simultaneous and inter-

related. The normal "nonclotting component" of postpartum blood may be analogous with the nonclotting component of menstrual blood, which this author believes also consists of two components—a clotting and a nonclotting. The same uterine enzyme which may be responsible for the failure of one of the postpartum blood components to clot may be responsible for the failure of one of the menstrual components to clot. Postpartum hemorrhage, when not due to uterovaginal tract trauma, may consist of a hemorrhage of (a) one of the clotting components, (b) the nonclotting component, or (c) a combination of any two, or all three. "Shock bleeding" may be a superimposed late complication.

The official recognition and physiological appreciation of the fourth stage of labor would result in a reduction of mortality from postpartum hemorrhage, which is assuming first place among the causes of maternal mortality. A questionnaire concerning the fourth stage of labor should be a part of every labor record. JOHN R. WOLFF, M.D.

NEWBORN

Page, E. W., Hunt, M., and Lucia, S. P.: The Antepartum Prediction of Hemolytic Disease of the Newborn. *Am. J. Obst.*, 1946, 52: 794.

Despite the intensive researches on the relationship of erythroblastosis fetalis to the Rh factor, the obstetrician is handicapped because he is unable to forecast the outcome of pregnancy in Rh-negative women. Not only is he in doubt about the presence or absence of erythroblastosis fetalis in utero, but he is also unable to predict its gravity when there are reasonable clinical indications that it may exist.

Ideally, all pregnant women should be typed routinely, regardless of parity, and in those Rh-negative patients having Rh-positive husbands, the first sample of blood for antibody determination should be obtained not later than the twenty-fourth week of pregnancy. If this be strongly positive for either agglutinating or blocking antibodies, an Rh-positive fetus will probably be too seriously affected by hemolytic disease to warrant any interference before term, while an Rh-negative fetus will escape the disease. As yet, there is no way of distinguishing these possibilities except to prove that the father is homozygous for the Rh factor. If the antibodies are present only in "traces," or if a small amount is found on a single determination and is unconfirmed by subsequent tests, the fetus is probably unaffected, and again it would be unwise to interfere.

If the initial sample is free of antibodies, but a significant amount appears later, a period of 8 to 10 weeks may be allowed to pass before hemolytic disease becomes a probability. After this time, induction of labor might be warranted provided the expected date of confinement is within the ensuing 6 weeks.

That a relationship exists between the duration of exposure to maternal antibodies and the fetal prognosis seems apparent. Further study may alter the critical time periods established by the data of this preliminary analysis. JOHN R. WOLFF, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Wagner, F. B., Jr.: Arteriography in Renal Diagnosis. *J. Urol.*, Balt., 1946, 56: 625.

Roentgenological delineation of the abdominal aorta and its branches in humans following direct translumbar injection of a radiopaque medium attracted considerable attention, but its seemingly formidable nature prevented general adoption. Although the technique is exacting, the indications limited, and the films sometimes difficult to interpret, the encouraging reports warrant its further trial in properly selected cases by qualified personnel.

The purpose of the present article is to stimulate further interest in this subject by the description of a simplified technique, critical evaluation of the procedure, and the presentation of some unusual arteriograms.

A team consisting of a surgeon, an x-ray technician, and an anesthetist is required.

The necessary equipment is: an antiseptic solution; gauze squares; drapes; rubber gloves; normal saline solution; talcum powder; rubber tubing with Luer lock adapters; a 15 cm., No. 18 gauge needle with stilet; skin puncture needle; a 10 c.c. Luer lock syringe; 80 per cent sodium iodide.

The x-ray machine should be capable of delivering 200 milliamperes. A high speed Bucky diaphragm should be used, allowing exposure within one-fourth of a second.

The anesthetist should be provided with pentothal anesthesia equipment and an oxygen machine. The preliminary preparations are as follows:

1. On the day of the procedure, a soapsuds enema is administered to the patient in the morning and food is withheld.

2. Morphine and atropine preanesthetic medication is given three-quarters of an hour before the procedure.

3. The sterilized arteriography tray, the pentothal anesthesia equipment, an intravenous set, 1000 c.c. of 5 per cent glucose in normal saline solution, a syringe containing 1 c.c. of epinephrine solution (1:1000), and another syringe containing 1.5 c.c. of coramine are sent to the examination room with the patient.

4. With the patient in the supine position, an abdominal film is taken in order to note adequacy of the colon preparation, to determine the best centering of the film with respect to the area of diagnostic interest, and to check the x-ray technique.

5. When this film is satisfactory, or after necessary corrections have been made, the casette is again loaded, and the patient is anesthetized lightly with sodium pentothal.

6. The skin of the lower chest and back is prepared with antiseptic solution and draped.

The technique of injection is as follows:

The twelfth rib on the left side is palpated. With a short stout needle, the skin is punctured just below this rib 4 fingers' breadth from the spinous processes. The 15 cm. needle is then introduced through the puncture hole and directed anteriorly, medially, and cephalically toward the body of the twelfth thoracic vertebra. When bone is encountered, the needle is withdrawn about 2 cm., and the point is directed more laterally so as just to pass by the vertebral body. The stilet is then removed and the needle cautiously advanced to within a few centimeters of its hilt. The aortic wall is encountered as a resistance through which the needle snaps, imparting to the operator a sensation similar to that experienced in penetrating the dura mater during a spinal tap. Almost immediately bright red blood emerges from the needle as a pulsating drip which descends as a rivulet on the shaft. In patients with hypertension, the flow is more rapid and pulsation somewhat more vigorous, but the amount of blood lost in making the necessary adjustments for injection is trivial. In some instances the needle itself may be seen to move rhythmically with each heart beat.

The needle is then connected to the rubber tubing and syringe which have been previously filled with sterile saline solution. Barbotage is carried out, to note the ease of flow in both directions. A trial injection of 12 c.c. of saline solution within 6 seconds is made in order to estimate the force required. The stopcock is then closed, and the syringe is disconnected and filled with approximately 12 c.c. of 80 per cent sodium iodide solution. The syringe is again connected, the stopcock opened, and blood withdrawn as a final proof that the needle is well within the lumen. The signal "ready" is given to the x-ray technician, the solution is injected at a rate of 2 c.c. per second, and the signal "shoot" is given as the final cubic centimeter or two leave the syringe. Since the tubing holds about 2 c.c., the total amount delivered to the aorta is about 10 c.c. Immediately following exposure of the roentgen film the needle is withdrawn.

It has been the author's experience that the technique as just described is best suited for visualization of branches of the celiac axis and superior mesenteric artery. Visualization of the renal artery and its branches appears to be better if the needle is inserted one vertebral level lower.

Promptly after injection, the patient usually moves slightly and breathes more deeply. During this period oxygen is administered by the anesthetist, and careful watch is kept of the patient's color, respirations, and pulse. The needle through which the pentothal was given is left in place and used for the administration of 1,000 c.c. of 5 per cent glucose in normal saline solution. Within 10 minutes the patient is usually conscious and has no complaints. Several hours later the patient is allowed his regular tray, and

ambulation is permitted if there are no other contraindications.

The author states that before abdominal arteriography is undertaken, one should be fully acquainted with the difficulties and potential dangers. In the first place, the patient is exposed to the hazards of anesthesia, acute iodism, extravasation of radiopaque medium, and hematoma following puncture. Secondly, the operator must acquire a thorough knowledge of the relational anatomy involved in the procedure. Aortic puncture should first be practiced in the dissecting or postmortem room in order to acquire experience and confidence. Thirdly, the actual technique, though relatively simple, is exacting and demands perfect co-ordination of the team, for the slightest error may yield an unsatisfactory film. Finally, even an excellent arteriogram in some instances may be difficult to interpret accurately because of the present lack of experience.

Even if the risk of abdominal arteriography in the hands of a competent team is granted to be minimal, the question arises as to whether sufficiently valuable information is obtained by the procedure to justify its performance. It is my opinion that this study is of value, just as arteriography elsewhere in the body, as an occasional diagnostic adjunct in carefully selected instances. From the standpoint of renal diagnosis the study may be indicated when all other studies have been exhausted and further information is desired regarding (1) hypertension in which surgical treatment is contemplated, (2) aberrant renal vessel as a possible cause of hydronephrosis, (3) renal or adrenal tumors, (4) possible renal aneurysm, and (5) suspected aortic obstruction near the renal arteries.

Further investigation and pooling of information with respect to interpretation of the arteriograms will, no doubt, establish the normal range of variation as well as the abnormal patterns. A rotating casette, permitting multiple exposures during injection of the radiopaque medium, would afford a more certain method of obtaining a good film during maximal concentration of the material in the area of diagnostic interest. Stereoscopic films would permit even more precise arteriographic delineation. Finally, in the near future cineroentgenography and the fluorographic multiple exposure technique may be successfully incorporated into the method.

JOHN A. LOEF, M.D.

Abeshouse, B. S., and Tankin, L. H.: Renal Complications of Sulfonamide Therapy. *J. Urol.*, Balt., 1946, 56: 658.

The authors discuss the following renal complications of therapy with sulfanilamide, sulfapyridine, sulfathiazole, sulfadiazine, and sulfamerazine: (a) crystalluria, (b) hematuria, (c) oliguria and anuria, (d) renal or abdominal pain or colic, (e) tenderness over the kidneys, and (f) azotemia.

Clinical reports of renal complications of sulfanilamide are rare. The authors have observed an unusual case of anuria following the intraperitoneal injection of from 75 to 85 gm. of sulfanilamide. Complete anuria occurred, but an autopsy was refused and the exact nature of the renal changes could not be ascertained.

In their series of renal complications of sulfapyridine, hematuria was observed in every one of the 12 cases and was accompanied by renal colic in 2 cases, and by urolithiasis, azotemia, and anuria in 1 case each, respectively. Cystoscopy was not done in any case. There were no fatalities.

In the authors' series of 12 cases of renal complications following sulfathiazole therapy, there were 7 cases of hematuria (3 cases uncomplicated, 1 with azotemia, 1 with crystalluria, 1 with oliguria, and 1 with anuria), 2 cases of crystalluria, and 3 cases of anuria. Cystoscopy and ureteral catheterization were employed in 3 cases. There were no deaths in this series.

Fourteen cases of renal complications of sulfadiazine are reported. Hematuria was encountered in 10 cases (2 cases uncomplicated, 4 with renal colic and azotemia, 1 with crystalluria, 1 with renal stone, 1 with oliguria, and 1 with anuria), oliguria and azotemia in 1 case, anuria in 1 case, and crystalluria in 2 cases. There was 1 death in this series. The death was preceded by anuria, and at autopsy, thrombosis of both main renal arteries was found.

The authors observed only 2 cases of anuria following sulfamerazine; 1 was accompanied by hematuria and 1 by renal pain. One of them was successfully treated by ureteral catheterization, and the other responded to conservative therapy.

Certain diagnostic aids are suggested. A daily urinalysis may allow detection of microscopic hematuria, one of the earliest signs of renal change. The presence of crystals in the urine without other signs or symptoms does not necessarily mean renal damage. Urinary infections predispose to the development of renal or ureteral complications. Obstructive lesions in the upper or lower urinary tract favor the accumulation of crystals or the formation of uroliths within the obstructed area.

Cystoscopy and ureteral catheterization usually establish the diagnosis.

The following precautions will reduce the incidence of renal complications: (1) determination of previous sulfonamide medication, sensitivity, or idiosyncrasy; (2) evaluation of the state of renal function prior to the administration of the drug; (3) evaluation of the state of hydration; (4) administration of the drug in adequate dosage; and (5) administration of adjuvant alkali therapy.

It is believed by the authors that the drug should be stopped immediately upon discernment of evidence of kidney damage, i.e., hematuria, renal pain or tenderness, suppression of the urine, and increased nitrogen retention. The fluid intake should be increased, and solutions of hypertonic dextrose and isotonic sodium lactate given intravenously. Sodium bicarbonate should be given by mouth until the carbon dioxide combining power of the blood reaches between 70 and 90 per cent. However, there is a warning against giving excessive amounts of fluids.

The use of mercuric compounds and acid diuretics is absolutely contraindicated. Ureteral catheterization and pelvic lavages, with warm water, isotonic saline solution, or from 2.5 to 10 per cent sodium bicarbonate solutions, are indicated when the pelves or ureters are obstructed by sulfonamide crystals. When all these measures fail, nephrostomy, pyelostomy, or ureteropyelostomy, with or without renal decapsulation have proved to be lifesaving in otherwise hopeless cases.

The cases reported by the authors were from the Sinai Hospital, Baltimore, Maryland.

JOSEPH E. MAURER, M.D.

Lundström, E.: A Belt for Compression of the Ureters (Guertel fue Kompression der Ureteren). *Acta radiol.*, Stockh., 1946, 27: 385.

Compression of the abdomen with the purpose of preventing the escape of contrast material into the urinary bladder is used for intravenous as well as retrograde pyelograms. The usual compression band which is attached to either side of the roentgen table causes pain in the patient whose back is pressed against the table. Furthermore, it immobilizes the patient and makes multipositional (especially oblique) roentgenography impossible.

The author describes an improved compression belt, the description of his first belt having been published in 1937. The present belt consists of an abdominal and a dorsal shield of radiotranslucent material, connected by straps. Rubber balloons of varying sizes (for unilateral or bilateral ureteral compression) can be inserted underneath the front piece and inflated to from 40 to 80 mm. Hg by means of a hand pump with a manometer.

The patient can be moved freely while the compression is being maintained. On the other hand, release of the compression can be accomplished by removing the front piece of the belt without disturbing the patient's position.

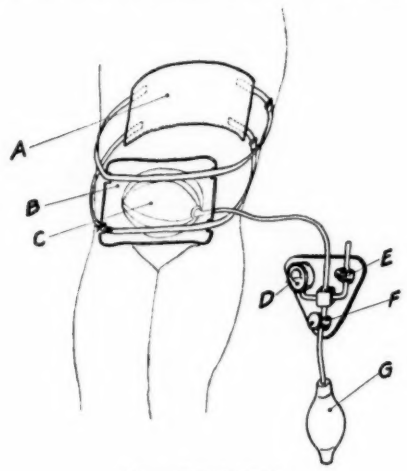

Fig. 1 (Lundström).

GERHART S. SCHWARZ, M.D.

BLADDER, URETHRA, AND PENIS

Emmett, J. L.: Management of Cord Bladder by Transurethral Resection. *J. Urol.*, Balt., 1947, 57: 29.

The author analyzes 45 cases of cord bladder cared for by transurethral resection at the Mayo Clinic during the years of 1944 and 1945. Thirty patients had transverse lesions of the cord and 15 had diffuse lesions. All of the patients carried a residual urine ranging from 50 to 1,200 c.c. The pattern of vesical dysfunction varied greatly, but consisted for the most part of involuntary active emissions of varying amounts of urine at intervals of from a few moments to an hour or more. This type of vesical dysfunction has been termed the automatic or reflex bladder. Most of the patients were reconciled to their partial motor paralysis but complained bitterly of a severe urgency of urination which made the wearing of some type of urinal necessary.

Transurethral resection as carried out in these cases has as its object the destruction of the internal sphincter's capacity to contract, and the removal of any obstructing tissue so that there will be no resistance of any kind between the bladder and the external sphincter. To do this, the entire circumference of the vesical neck, well out to the verumontanum, must be resected. Multiple resections are frequently necessary before the patient can empty completely.

The results in 30 cases of transverse myelitis were encouraging. Twenty-three patients were considered to have obtained a good result; 4 were improved; in 2 patients the results were fair, and in 1 patient, poor.

Fifteen patients with multiple sclerosis or miscellaneous lesions of the cord, were studied. Usually, these patients were found to have frequency and urgency of micturition with a poor stream. In advanced cases, the patients complained of a precipitate urgency. Three of 7 such patients obtained a good result; in the remaining 4, the results were classed as fair.

It is emphasized that the performance of resection by no means treats the neurological lesion. In the final analysis the attempt with this procedure is to eliminate residual urine so as to allow the patient to remain dry until an amount equal to that of residual urine accumulates in the bladder. This accomplished, he may be kept dry and free from cumbersome catheters and urinals, thus greatly aiding his entire program of rehabilitation.

Excellent charts analyzing each of the cases are presented.

ROBERT O. BEADLES, M.D.

Lewis, E. L.: Tuberculosis of the Penis. *J. Urol.*, Balt., 1946, 56: 737.

Tuberculosis of the penis is a rare clinical entity. Two types have been recognized: (1) that which is secondary to other lesions in the genitourinary system,

(a) upper tract, (b) genital tract, and (c) both; and (2) that which is primary, i. e., no other source of tuberculosis in the body is present. There have been only 3 cases reported in which the penis became involved following pulmonary tuberculosis without there being some other genitourinary focus first.

Tubercle bacilli may involve the skin, the urethra, or cavernous bodies. Tuberculous cavernitis is a very rare disease and is not considered in the present study except where it may arise secondarily to skin tuberculosis.

The urethral mucosa is remarkably resistant to the tubercle bacilli, which may pass through it for years without producing clinically recognizable lesions (Young). Even so, tuberculosis of the urethra is a more common disease than that of the penis; it was present in 2.6 per cent of the cases of upper tract tuberculosis in the author's files, whereas penile tuberculosis was present in just less than 1 per cent of cases.

In a comprehensive review of the literature, there have been found 110 cases of penile tuberculosis. In 89 of these, the condition was primary; in 9 cases, not stated; in 8, secondary; in 1 case, undetermined; and in 3 cases, hematogenic.

Of the 89 cases of primary tuberculosis, 72 were the result of ritual circumcision in Jewish infants. The actual incidence of tuberculosis of the penis following this rite was much higher than a review of the literature would indicate. Part of the ritual consisted of the mohel sucking the circumcised penis in the act of the Mezizah. The purpose of this act, which was compulsory, as described in the Camera by Rev. Rav. Pope in the fifth century, and later by Joseph Karo and Maimonedge in the Beth Joseph of the twelfth century, was that of a hemostatic and styptic. Syphilis and diphtheria have also been contracted through this act. After the turn of the last century this act was practically eliminated from the ritual so that tuberculosis of the penis is seen only rarely now.

Of the remaining 17 primary cases, 12 were definitely stated as being the result of coitus, 2 were the result of nonritual circumcision, 2, the result of buccal coitus, and 1 case resulted from the wearing of infected clothing.

Of the secondary cases, 4 patients had tuberculosis involving the genital system, 2 had renal involvement, and both the urinary tract and genital tract were involved in the other 2 patients.

In the Brady Urological Institute, there have been seen 7 cases of tuberculosis of the penis, 5 of which the author reports.

As has been demonstrated, the penis may become infected with the tubercle bacilli through three sources: (1) hematogenous from lungs, (2) direct contact, and (3) following tuberculous infection of other organs in the genitourinary system by one of the above methods or by some other method not demonstrated as yet.

The hematogenous route without involvement of other genitourinary organs is an extreme rarity.

The direct contact source is by far the most common source of infection. One can easily see how the bacilli could gain a foothold during circumcision, but the contraction of the disease through coitus is another matter. The tubercle bacilli can be found in the vagina in cases of pelvic tuberculosis in women, and even though cervical tuberculosis is a rare disease it has been seen and shown to be of primary as well as secondary origin. This being so, and the fact that the lesion appears around the corona and frenulum most commonly, leads one to speculate that the bacilli are inoculated in these points of irritation, the normal mucosa having been shown to be highly resistant.

There have been many descriptions in the literature of the typical lesion of tuberculosis of the penis. Brunati describes 3 periods in the development of the tuberculous ulcer. The first period is one of a tuberculous pustule, which he calls a "bouton" or raised pimple. In this stage there is little or no induration. In the second period there is ulceration but still little or no induration. The third period is marked by a progression of the ulceration, and the presence of infiltration and induration around the edges. The base, in the early stages of this period, is usually clean and has the appearance of irregular granulation tissue. With extension of the lesion there is necrosis, the base becomes gray or yellow, and usually there is secondary infection.

The differential diagnosis of penile ulcers is not simple. There are many diseases to be considered, viz., balanitis, herpes progenitalis, chancroid, luetic chancre, epithelioma, carcinoma, gummatous ulceration, granuloma inguinale, and leprosy.

Because of its rarity, the diagnosis of tuberculosis should not be made until all other possibilities have been ruled out. The diagnostic proof should consist of smears stained for acid-fast bacilli, biopsy, and finally animal inoculation. In only the last of the cases here presented was all this done.

The treatment of penile tuberculosis has been most unsatisfactory. Suggested therapy has been heat, light (both ultraviolet and infra-red), x-ray, various chemicals, and surgical excision. None of these methods has proved to be a panacea. In some cases excision with the electric cautery can be done with some optimism for the patient, but the prognosis generally is quite poor.

JOHN A. LOEF, M.D.

MISCELLANEOUS

Reaves, J. U.: Surgical Injuries of the Urinary Tract. *J. Urol.*, Balt., 1947, 57: 65.

Injuries to the urinary tract are of two types: (1) those which allow urinary absorption without extravasation, and (2) those which allow extravasation and absorption. When urinary extravasation is set up, the urine follows every conceivable plane, giving unlimited variety to the fistulous tract. The scope of the present paper deals only with those cases which are due to surgical trauma, or to external violence, as is sometimes encountered in private practice.

Accurate diagnosis of fistulas following injury to the kidneys can be made as a rule by the properly combined use of urologic and roentgenographic sur-

vey. The presence or absence of hematuria is noted, and either intravenous or retrograde pyelograms are made according to the operator's judgment, remembering that temporary anuria can result from either moderate or severe trauma of the kidneys.

Immediately following an injury in which the kidney is involved, the patient complains of pain and tenderness in the iliocostal area. The pulse rate is rarely accelerated and the blood pressure will remain at a safe level. Muscle spasm in the area is usually due to the degree of injury to the muscle. Pain, tenderness, and muscle spasm may be accompanied by shock, though shock is rarely severe unless the kidney injury is complicated by injuries to other structures. If the pulse rate is accelerated and accompanied by restlessness and the pain and muscle spasm increases, one may be certain that progressive bleeding is going on. Likewise, a fall in blood pressure several hours following injury is often caused by bleeding. In the opinion of the author, this should put an end to expectant or conservative treatment, and exploratory surgery should be instituted.

The anatomical position of the ureters, together with elasticity, gives them a large degree of protection from injury. The possibility of the ureter being nicked or severed by a gunshot or stab wound is remote, though this could happen. If the ureter is injured at the same time the kidney is damaged, the kidney disease is dealt with primarily, and in so doing the ureter also comes in for attention. This may be simple ligation of the ureter and removal of the distal portion thereof during a nephrectomy, or drainage and plastic repair accomplished according to the presenting indications. Sometimes the ureter is injured during resection of the sigmoid for malignant growth, rendering a condition which is so aggravating that nephrectomy has to be resorted to.

Injury to the ureter is not always recognized at the time of operation. A fatal peritonitis may result from an unnoticed rent in the urinary tract with the escape of urine into the peritoneal cavity. Complete anuria or the presence of hematuria may reveal ligation or other injury to the ureters. The appearance of urine on the dressings or through the vagina may be the first notice of operative injury.

Newell states that there are no definite symptoms in unilateral ligation of the ureter, that the death of the kidney occurs before the ligature is absorbed, and in such cases the effect of this ligation may not be observed.

Distortion of the urinary tract by pelvic disease can be ascertained by a preoperative urological survey. This will also show up double ureters, Y ureters and the like, and make it easier for the gynecologist to be on the alert to avoid injury to the ureters. Likewise, an early urological survey postoperatively will show the degree of damage of malplacement left with the patient following the operative procedure.

Operative injuries to the bladder are more rare than ureteral injuries, as it is extremely difficult to injure the bladder when it is empty and contracted; however, fatal peritonitis may result from an unnoticed rent in the bladder, allowing the escape of urine.

One of the most difficult urological problems is that which accompanies or follows posterior resection of the rectum, or combined abdominoperineal resection. The urinary retention and infection must be held to a minimum when this complication is present. The explanation most frequently accepted is that which attributes this complication to injury to the parasympathetic nerves which control the urinary bladder. Just why this urological condition should exist at all has never been adequately explained. Trauma to the prostate, posterior urethra, and seminal vesicles, and further disturbing the supporting structures around the base of the bladder during this operation tend to set up a condition wherein the bladder decompensates, and is found unable to expel urine through a moderately obstructed vesical neck. When this condition exists the vesical neck should be weakened by resection, thus obviating the imbalance existing between the vesical neck and the detrusors. This procedure is not to be attempted until enough postoperative time has elapsed for the patient to regain his vesical function.

Hinman classifies rupture of the urethra as being of four types: (1) of the pendulous portion, (2) of the bulbous portion anterior to the triangular ligament, (3) of the bulbomembranous portion anterior to the triangular ligament, and (4) membranoprostatic portion at, or posterior to, the triangular ligament. Dodson states that, with few exceptions, rupture of the urethra occurs as the result of a direct blow of the perineum, forcing the urethra against the pubic arch, or as the result of fracture of the pelvic bones.

The author has seen 9 cases of fracture of the urethra, followed by extravasation of urine, in which the bladder was filled close to its capacity at the time of injury. It is believed that the weight of bladder urine, and the movability and sudden jerk caused by the traumatizing agent makes a more complete and extensive laceration of the urethral tear. In such cases the patient's attempt at voiding is not met with success, and it is usually accompanied by such severe pain that immediate relief is sought.

If perineal repair of the divided urethra is required, the urinary diversion and urethral repair can be accomplished and the hemorrhage controlled by exposure per perineum. It is not always easy to find the distal ends of the severed urethra; in some cases it is necessary to open the bladder suprapubically and to pass a sound posteriorly as well as through the perineal wound, or through the urinary meatus, in order to approximate the severed ends of the urethra. Retrograde instrumentation is always best in these cases. After the 2 ends of the urethra are located the repair is easy. The author uses end-to-end anastomosis and perineal closure after a free resection of all bruised tissue and the traumatized ends of the urethra, together with closing of the bleeding points in the ruptured membranous bulb, if such existed.

JOHN A. LOEF, M.D.

Deming, C. L.: Drainage and Irrigation of the Urinary Tract. *J. Urol.*, Balt., 1947, 57: 49.

The modern conception of drainage and irrigation of the urinary tract not only implies relief of obstruction and cleansing of the tract by irrigation, but embraces a consideration of the physiology, bacteriology, and pathology of the tract, as well as the prevention of cardiovascular disease, renal complications, and hypertension. To accept the principle that any drainage or any so-called tidal irrigation will function continuously without attention is like expecting that your automobile will run continuously without regular and proper adjustment. The fact that the insertion of a drainage tube into any uninfected bladder or kidney will result in an infection of that organ is not yet universally recognized. Irrigations, including the so-called tidal drainage for the bladder, do not prevent invasion by bacteria, nor does an irrigation completely sterilize organs lined with mucous membrane; it causes only a mechanical cleansing of the epithelial surface; and, consequently, any irrigation which will cleanse the surface without producing a chemical irritation will be efficacious.

The directives issued by the Army during the last war relative to so-called cord bladder lesions have required suprapubic drainage and indicate recognition of the inadequacy of interval catheterization and tidal drainage. Slow decompression of the distended bladder is now generally conceded unnessary if precautions are taken against a sudden and serious infection. Likewise, it would seem that tidal drainage is doomed or that it will be replaced by less complicated mechanisms. The author has not used the so-called tidal drainage for more than 4 years because of its inadequacy and complexity.

The apparatus for urethral bladder drainage and irrigation which has been used for several years is simple, efficient, economical, and gives little trouble. The author claims no priority with its use. It consists of a three-way catheter and flask of irrigation fluid so constructed as to be a closed system. The apparatus used is the ordinary Fenwal flask which contains physiological saline, and is the same apparatus as is used for clysis and intravenous therapy. The hospital always has a ready supply of flasks filled with sterile physiological saline. When one bottle is empty it is just a matter of removing the glass rod from the empty flask and inserting it into the new one, always keeping the irrigating fluid sterile and the system a closed one. Patients never complain of burning or smarting from the irrigation. If the outflow becomes occluded the inflow usually ceases. If the return fluid becomes cloudy it is a simple matter for the nurse or the doctor to allow the flow to run faster for a minute or two, or until the return fluid is clear. This can be done at any visit at the bedside. No added apparatus or personnel are necessary to irrigate the bladder adequately. The bladder remains collapsed except now and then, and the base is constantly irrigated, so that there is very little opportunity for absorption of infection and development of upper urinary tract complications. It is an improvement on tidal drainage, even when used for irrigation of the paralytic bladders.

By means of this apparatus, preoperative prostatic patients with residual urine are given a continuous saline irrigation, by means of a Foley 18F. or 20F. catheter. Transurethral resection cases are treated similarly, as the catheters rarely become obstructed, and the bleeding is not exaggerated or prolonged. Following suprapubic prostatectomy, irrigation is carried out similarly, via urethral catheter and suprapubic tube. After 3 to 5 days the suprapubic tube is removed and the wound is allowed to heal. Patients are treated in the same manner following perineal prostatectomy by continuous irrigation through the catheter and perineal tube. After removal of the perineal tube continuous irrigation through the urethral catheter is continued as long as the catheter remains, to keep the bladder and the wound clean.

Much has been written about the drainage of the space of Retzius, and many surgeons seem to have been "bogged down" in this space. Numerous methods of drainage and various kinds of drains have been inserted. Prolonged drainage has produced complications of a permanent fistula and even osteomyelitis of the pubic bones. The author wishes to call attention to the last contribution of the late Henry Morton, in which he stressed the fact that when the operator exposes the bladder suprapubically he should incise the pubovesical or prevesical fascia transversely, turn it down, and thus avoid opening the space of Retzius. If the space of Retzius is not opened it is unnecessary to drain this area in operations on the bladder.

Boyd has shown the advantage of a rubber tissue drain inserted down to the muscular layer at the upper angle of a long incision in a fat abdominal wall or when the wound is severely contaminated by the bladder contents. However, due to the advent of sulfa drugs and penicillin this is now rarely necessary.

Drainage of the ureter has given some surgeons much concern, and as one visits various sections of the country one finds draining ureteral fistulas. It has been our fortune not to have been troubled with ureteral fistulas. It must be remembered that ureteral wounds heal readily if given half a chance, provided that there is freedom of flow of urine in the ureter distal to the wound. Uninfected ureterotomy incisions heal well if a closure of the serous layer be done with fine catgut (00000). If the incision is made on the under side or posterior side, similar to a posterior pyelotomy wound, there is rarely any leakage. In cases in which the ureter is large and the urine is purulent, a gall bladder T-tube inserted for a couple of weeks has given the most satisfactory drainage. It allows for irrigation of the whole ureter and free drainage, and the wound rarely leaks urine after the T-tube has been removed. The T-tube is also of advantage in making an anastomosis of an accidentally severed ureter, or in segmental resection of the ureter with end-to-end anastomosis.

The surgical drainages of the kidney are too numerous to describe; also, the various tubes and

combinations of tubes are many. However, the irrigations of the kidney are few and limited mostly to an attempt to dissolve renal calculi with phosphoric acid or the so-called Suby's solution. It is a generally accepted fact that if the kidney is to be drained surgically, nephrostomy drainage is preferable to pyelostomy drainage. It is agreed by all that large pyonephrotic kidneys respond better to a large nephrostomy tubular drain passed through the cortex into the pelvis of the kidney and that such drainage shall remain until as much of the restoration of the renal function as possible has been obtained.

The solution of the problem of reconstruction of the kidney pelvis and its drainage in cases of hydronephrosis has been attempted by a number of surgeons, with success by many of them. Two facts are paramount: the first is that if there is an infection the pelvis must be drained; the second is that enough of the hydronephrotic pelvis must be removed to prevent pooling of the urine, which often causes a rupture of the suture line and a perirenal infection, or recurrent fibrosis at the operative area. After excising the ureteropelvic junction and excess pelvis the anastomosis of the upper ureter is made to the dependent portion of the pelvis over a T-tube, 12 to 16 F., whichever best fits the ureter. It is unnecessary to disturb the renal cortex or drain the kidney with a nephrostomy tube. The T-tube acts as a splint and is removed about the sixteenth day. In only one of the author's cases was there a leakage of urine after removal of the tube, and that occurred for only part of a day.

Operations upon the uninfected obstructed kidney, now more than ever before, are due for more serious reflection. We recognize the fact that hypertension may be due to renal ischemia. Theoretically, may not such a lesion, however minute, be initiated by introducing an infection into the kidney, or by a nephrostomy wound plus an infection, even though the renal wound heals and the infection later clears? Cases in which the kidney is already damaged by obstruction, ideally speaking, should have surgical correction without drainage, and the resulting temporary infection or a cortical injury by a nephrostomy. Such surgery demands careful and painstaking technique. Few authors indeed there are who advise the primary closure of a pelvic incision without drainage of the urinary tract. The risk of a bad result looms large to the uninitiated, but the purpose demands exacting surgery which we must promote if we are to progress in renal surgery. Hypothetically the idea is sound and should be recommended and executed more often, because we see patients who come without infection, who are operated upon and are left with an infection which is never controlled.

JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

De Leo, F.: A Contribution to the Pathogenesis of Volkmann's Ischemic Paralysis (Contributo alla patogenesi della malattia di Volkmann). *Chir. org. movim.*, 1946 30: 90.

The author shows a series of microscopic sections of tissue specimens taken from muscles afflicted with Volkmann's ischemic paralysis. He shows the various grades of muscular changes from mild hyperplasia of the connective tissue, through the stages of collagenous infiltration about the muscle fibers, to complete replacement of the muscular elements by fibrous tissues to a condition which he calls cirrhosis muscularis.

After a review of the literature and on the basis of his personal experiences, the author states that it is his opinion that the etiology of Volkmann's ischemic paralysis is pressure produced by hemorrhage and edema in the cubital area of the arm, which becomes encased by the deep fascia of the arm until there is a definite ischemia of the nerves in the elbow region, usually involving both the median and radial nerves.

For this reason the author believes that the only treatment for Volkmann's ischemic paralysis is a long slitting of the deep fascia of the arm with exposure of both the median and radial nerve roots in the cubital area. He believes that by this method only can the numerous trophic changes which occur in the hand be avoided and, also, only by this means can the marked destruction of the muscle tissue be prevented. He goes into considerable detail as to why he believes that the prime etiology is not, in itself, due to vascular impairment but to direct pressure on the nerves with resulting trophic changes.

CARLO SCUDERI, M.D.

Cahuzac, M., and Jung, F.: Contusion of the Humeral Artery; Spasm of the Vessels; Volkmann's Syndrome (Contusion de l'artère humérale. Spasme vasculaire. Syndrome de Volkmann). *Rev. orthop.*, Par., 1946, 32: 241.

A child of 10 years fell on her wrist while playing and fractured her right elbow. This was on September 4. There was great pain at the site of fracture and the arm was cold and "dead" below it.

The roentgen examination showed a supracondylar fracture of the elbow and physical examination revealed all the typical nervous and vascular complications. Because of repeated fainting spells operation was delayed until the next day.

An incision over the internal bicipital groove showed that the humeral artery and the median nerve were contused. When the artery was freed the circulation appeared to be restored to normal and the fracture was reduced. Recovery seemed to be proceeding normally until September 17, when the child complained of intense pain in the forearm and coldness and pallor of the hand. As a stellate ganglion injection could not be made on account of the child's intense fear, a perihumeral injection of novocain was given above the cast. On October 6 the cast was removed. On December 4 the hand was cold and violet colored, and on slight extension of the wrist, the fingers contracted spasmodically in a typical Volkmann's contracture. Active movements were very limited.

Therefore, 3 months after operation for a supracondyloid fracture with contusion of the humeral artery and median nerve there was a typical Volkmann's syndrome due to vessel spasm. Ten perihumeral infiltrations of novocain were given and the child gradually recovered.

This case shows all the typical results of arterial spasm and it also shows the efficacy of operations on the sympathetic nervous system in Volkmann's contracture. This syndrome begins slowly and surgery of the sympathetic nerves may cure or improve the condition for a long time after the accident. In this case the authors believe that the early operation with release of the constriction of the artery prevented the development of a much more serious picture. Probably a sympathectomy at the time of the initial operation would have prevented any contracture.

AUDREY G. MORGAN, M.D.

Morandi, G.: The Indications and Results of Surgical Reconstruction of the Thumb (Indicazioni e risultati della ricostruzione chirurgica del pollice.) *Chir. org. movim.*, 1946, 30: 41.

The author reports on 17 cases which came under his observation at the Putti amputation center at Bologna. Two cases involved the upper extremity after the thumb had been lost, and 15 involved both upper extremities.

The operative procedure which he recommends is the surgical removal of the second and third metacarpal bones, which leaves a sufficient amount of skin for the closure of the cleft resulting from prolongation of the depth of the web between the first and second metacarpals. In addition, it gives a space that is sufficient for the production of grasping power; this power is limited if the second and third metacarpals are not removed.

There are 25 illustrations in this article showing the "before" and "after" findings in a number of cases.

There is no question that with the removal of the second and third metacarpals the hand is smaller, but there is definitely a thumb that can be brought over to grasp something against the remaining fourth and fifth metacarpal bones.

In all 17 cases, a very satisfactory result was obtained. The author stresses the point that this pro-

cedure is much less formidable and the period of disability of the patient is far shorter than in any other form of thumb reconstruction that has been recommended in the past, such as the transplantation of tibial grafts covered by skin or transplantation of the toes into the stump of the thumb.

CARLO SCUDERI, M.D.

Cabras, G.: Spondylolisthesis (Spondilolistesi). *Chir. org. movim.*, 1946, 30: 57.

The author gives a very fine résumé of the historical background of spondylolisthesis. He presents 10 cases of his own.

The author gives a very excellent review of the subject including a bibliography.

In concluding he states that spondylolisthesis should be treated by long immobilization in bed followed by local heat and massage and in some cases by the use of x-rays. The patient is then permitted to be up and about, always wearing a plaster jacket that is light and very form fitting. Under this regimen the majority of the patients are relieved of pain in the area of the spondylolisthesis. Although the author discusses the different forms of spinal fusion in detail, he does not suggest it as treatment and in none of his cases was any spinal fusion performed.

CARLO SCUDERI, M.D.

Martin, P.: Pyogenic Osteomyelitis of the Spine. *Brit. M. J.*, 1946, 2: 688.

Pyogenic osteomyelitis of the spine is approximately three times more common in males than in females, and usually the age of onset is in the third decade, that is, after the vertebrae are fully formed, thus differentiating it from osteomyelitis occurring in the long bones. There is no true epiphysial growth in the vertebral bodies such as one finds in the long bones. This may account in part for the occurrence of the condition in the third decade or later.

These cases are often so acute and fulminating, and toxemia is so intense, that an antemortem diagnosis is not made. The author believes that in many cases the condition labeled tuberculosis of the spine, which responds so well to early firm bony fusion, is in reality a pyogenic osteomyelitis.

The lumbar region is most frequently involved and the bodies of the vertebrae are generally affected. This is usually a metastatic phenomenon, the primary focus being recognizable in about one-half of the cases as a topical infection such as a boil, whitlow, tooth infection, septic wound, or another focus of osteomyelitis. The causative organism, if it can be obtained directly or by blood culture, or from the primary focus, is a Staphylococcus aureus, less commonly a Staphylococcus albus or, rarely, a streptococcus.

The treatment for pyogenic osteomyelitis is immobilization of the spine, preferably in a plaster bed, until the disease process has subsided and bony fusion is complete. Penicillin is advocated both locally and systemically. If abscesses form, evacuation is recommended. A fusion operation is thought to be unnecessary.

A series of 4 cases is reported.

C. FRED GOERINGER, M.D.

Delitala, F.: Localization of Paget's Disease in a Single Vertebra (La localizzazione vertebrale isolata nel morbo di Paget). *Chir. org. movim.*, 1946, 30: 133.

Several diseases have been named for Sir James Paget, a distinguished English physician and student of surgical pathology. In this article the author discusses Paget's osteitis deformans. He collected 110 cases from the Rizzoli Institute, the Orthopedic Clinic of the University of Bologna. Twenty of these cases are described and illustrated with roentgenograms. In 10 of these cases the lesion was localized in a single vertebra while in the remaining 10 several vertebrae or other parts of the skeleton were involved.

The disease is probably of endocrine and sympathetic origin, although the chief factor is not known. Clinically, there is loss of teeth, deafness, difficult nasal respiration, change in the form and size of the skull and bones of the limbs, rheumatoid pain, and a condition of asthenia. Differential diagnosis is impossible, however, without an accurate knowledge of the roentgen picture of the affected bones. In the case of disease of the vertebrae the affected vertebra shows a dense structure like that of marble (osteolytic type), or large trabeculae arranged irregularly and more transparent than normal (osteoporotic type) because they are made up of osteoid tissue. The vertebra is often enlarged and flattened out between the two adjoining ones. Sometimes the two forms are combined. In advanced stages of the disease the hypertrophy of bone is often extreme.

AUDREY G. MORGAN, M.D.

Dundon, C. C., Williams, H. A., and Laipply, T. C.: Eosinophile Granuloma of Bone. *Radiology*, 1946, 47: 433.

The authors analyze the literature on 48 cases of eosinophile granuloma of bone and add 5 cases of their own.

The condition occurs more frequently in males, in the ratio of 5 to 1. The age of the patients ranges from 6 months to 58 years. Thirty-four of the patients were under 20 years and 20 were under 10 years. Nearly all of the bones proximal to the wrists and ankles were involved. Thirty-six patients had single lesions and in 36 per cent of these the skull was involved and in 16.6 per cent the ribs and femurs. Most patients had from mild to severe pain, swelling of the soft tissues, and tenderness to pressure. A few patients had mild systemic reactions, fever, anorexia, lassitude, and weight loss.

Laboratory examinations showed essentially normal conditions except for slight leucocytosis and occasional eosinophilia of from 4 to 11 per cent. Roentgenographic examinations showed round, oval, or irregular areas of decreased density, usually from

Fig. 1. (Dundon, *et al.*) Anteroposterior view of the left femur made April 6, 1945, 10 weeks after the first symptoms. The destructive lesion of the femur measures 3.5 by 2.5 by 2.0 cm. There is mild peripheral sclerosis. Periosteal reaction appears along the medial margin of the femur.

Fig. 2. Photomicrograph illustrating focal necrosis (on left), proliferated collagenous connective tissue with many lymphocytes and eosinophils. Hematoxylin and eosin. (x 140.)

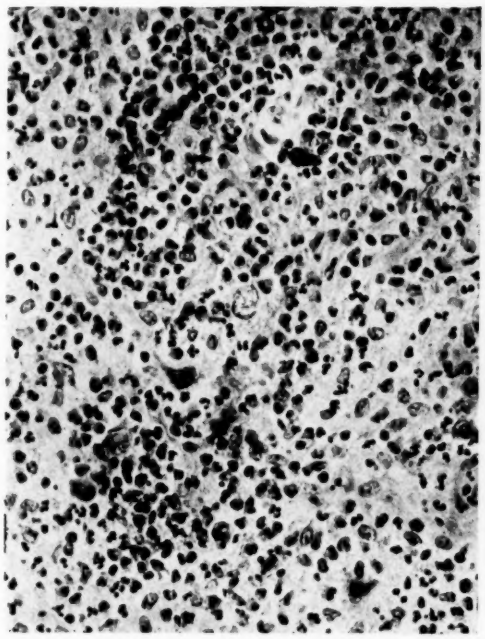

Fig. 3. The lesion of the left femur shows peripheral healing 5 months after curettement and phenol cauterization. It measured 3 by 2.5 cm. on October 26, 1945.

Fig. 4. Case 5. Oblique view of the right side of the pelvis made April 24, 1945, showing a destructive lesion 4.5 by 3.5 cm. The margin of the bone defect is irregular in outline and poorly defined in some areas.

1 to 4 cm. in diameter. The lesions produced expansion of the bone in 5 cases and perforation of the cortex in at least 5 cases. Periostitis was present in 14 cases, and 3 lesions had sclerotic margins.

At operation the early lesions contain soft, friable, yellowish brown and red material. Microscopically, the characteristic cell is a large mononuclear cell with granular cytoplasm. There are a variety of other cells, including large numbers of eosinophils. Treatment by surgical excision, curettage, or irradiation has given good results. No death has been attributed to the disease. VERNON C. TURNER, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Renon, C., and Calvez, L.: Screwing the Ruptured Tendon of the Long Portion of the Brachial Biceps into the Diaphysis of the Humerus (Le vissage disphysaire dans les ruptures de la longue portion du biceps brachial). *Rev. orthop.*, Par., 1946, 32: 253.

Rupture of the tendon of the long head of the biceps may result from violence or it may occur in longstanding arthritis of the shoulder without any unusual effort. The authors describe a case in a man of 42 years who on lifting a sack weighing 75 kgm. felt intense pain and a tearing sensation in the left arm. Examination revealed rupture of this tendon.

The authors recommend screwing the end of the ruptured tendon into the humerus in the bicipital groove at the level of the muscle insertion to accomplish fixation of the fleshy body of the muscle in the normal position. The thing to be avoided is too low fixation of the ruptured tendon. It is simple and easy. The review of a case operated on in this way 18 years ago shows that there is no injury to the bone from the screw. A Lambotte screw 3 cm. long is passed through the tendon; needless to say, the tendon must be sufficiently solid and intact so that the screw can be passed through it without tearing. An opening for the screw is made in the humerus with a perforator and the screw fixed in it. The arm is then kept in plaster for 3 weeks with the elbow at a right angle.

Blondin and Roy have recently recommended suture of the ruptured tendon to the anterior branch of the V-shaped insertion of the deltoid tendon. The authors do not advocate the complete replacement of this method by that of screwing. Both have their indications. AUDREY G. MORGAN, M.D.

Gherlinzoni, G.: Surgery of Spastic Deformity of the Wrist and Hand (Contributo alla chirurgia delle deformità spastiche del polso e della mano). *Chir. org. movim.*, 1946, 30: 176.

The results of surgery in spastic deformity of the wrist and hand have been so poor that many surgeons have given up all attempts at surgical management of this condition. Statistics from the Orthopedic Hospital in Los Angeles show that among 1000 cases of spastic deformity in childhood, 542 operations were performed: only 65 of these were on the upper limb, 21 on the wrist and 10 on the hand.

The author discusses 25 cases operated on at the Rizzoli Institute, the Orthopedic clinic of the University of Bologna, for spastic deformity of the wrist and hand resulting from the tetraplegic form of Little's disease and infantile cerebral hemiplegia. Some of these cases were caused by spasm of the muscles of the forearm and others by spasm of the muscles of the hand itself. The degree of flexion of the wrist varied from a very slight one to one so extreme that the palm of the hand rested against the forearm. The operations performed in these cases were plastic elongation of the flexors of the wrist, arthrodesis of the wrist, capsuloplasty of the radiocarpal joint with tendon fixation of the radial extensors and tendon transplantation at the wrist.

The latter operation was performed in 15 cases. In the great majority of the cases the tendons transplanted were two—those of the palmaris longus and of the anterior cubital muscles, the former being fixed to the extensor pollicis longus, the radialis, or the extensor communis, and the latter chiefly to the extensors ulnaris or radialis of the wrist. Cases are illustrated, showing just what tendon transplantations were made and the results of the operations.

Tendon transplantation is the preferred operation in these cases. The esthetic results were good in all, the deformity being permanently corrected. In 8 of the cases a certain degree of function was restored Complete restoration of active motility is not to be expected

Cases for operation must be carefully selected. Those in which brain function is too much affected or in which choreoathetoid manifestations or deformities of the bones and joints are present must be excluded. AUDREY G. MORGAN, M.D.

Delitala, F., and Pais, C.: The Reduction and Arthrodesis of Old Unilateral Congenital Dislocations of the Hips (La riduzione-artrodesi nella lussazione congenita inveterata unilaterale dell'anca). *Chir. org. movim.*, 1946, 30: 1.

The authors definitely believe that old congenital dislocations of the hip which are unilateral in type should be fused once they begin to give manifestations of progressive pain, deformity, and poor walking habits. No other method, do they think, gives as gratifying a result and as great a possibility of success as arthrodesis. The freedom from pain, the stability of the hip, and the better walking habits of individuals with old dislocations of the hip, certainly more than compensate for the loss of motion in this one articulation.

The authors believe that an arthrodesis is far preferable to the old Lorenz bifurcation operation or subtrochanteric osteotomies which are performed by some men. In a few selected cases they believe that the shelf operation is of value—when there is a fairly good acetabulum and not much evidence of subluxation or osteoarthritic changes associated with pain.

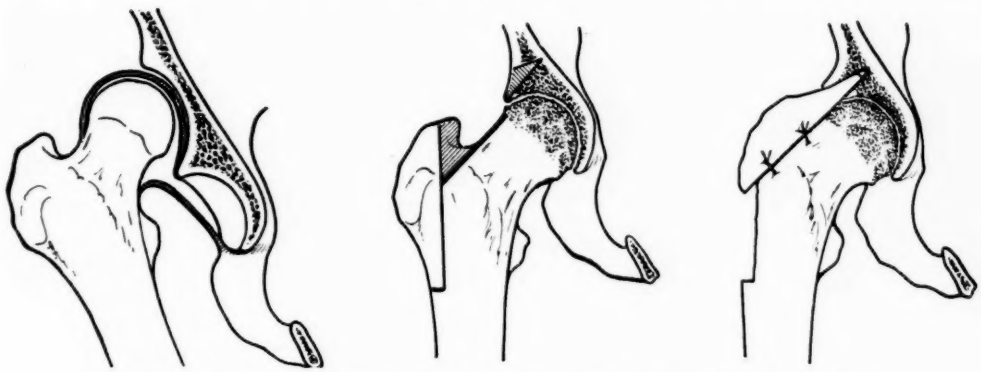

Fig. 1. (Delitala and Pais) Diagrammatic operative procedure for reduction and arthrodesis.

The operative approach which is recommended by the authors is a lateral incision extending from the crest of the ilium down along the line of cleavage between the tensor fascia femoris muscle and the gluteus medius muscle along the anterior aspect of the shaft of the femur for a distance of about 4 inches. Then by subperiosteal dissection the gluteus medius, minimus and maximus, are retracted posteriorly and the tensor fascia femoris is retracted anteriorly. The capsule is then exposed and cut by a "T" incision with the base along the intertrochanteric line. This permits a good exposure of the head and neck. The ileopsoas muscle is then cut at its attachment to the lesser trochanter. The cartilage from the head is removed and the acetabulum is drilled out so that all cartilage has been removed, and the fresh bone of the head and acetabulum are brought in contact. Then by use of a motor saw, the greater trochanter and a portion of the upper part of the shaft of the femur are cut and the Hibbs' procedure is used for performing the arthrodesis of the hip by inserting the reversed end of the greater trochanter femoral shaft portion of bone into just above the superior lip of the acetabulum. The patient is then immobilized in a hip spica until such time as the x-rays show a solid bony union of the arthrodesis.

The author states that it is imperative that the ileopsoas tendon be severed from the lesser trochanter, otherwise it is most difficult to obtain a sufficient looseness of the hip articulation to produce a satisfactory reduction and replacement of the head in the acetabulum with sufficient abduction to maintain a good position of the arthrodesis of the hip. The authors also state that because of the fact that there is an actual lengthening of the leg from its previous position, it is necessary to keep the knee flexed at least to an angle of from 45 to 50 degrees at the time that the cast is applied so as not to produce vascular and nervous changes in the extremity. The knee is extended at the end of 2 months when the cast is changed and then another cast is applied which is maintained for a period of 3 to 5 months thereafter until such time as x-ray evidence of a solid bony union occurs.

The authors are reporting on their experience with 10 operative cases. The patients ranged from 14 to 30 years of age. One case was followed up for a period of 20 years. CARLO SCUDERI, M.D.

Pais, C.: Secondary Osteosynthesis in Operative Elongation of the Femur (Osteosintesi secondaria nell'allungamento operativo del femore). *Chir. org. movim.*, 1946, 30: 159.

The author describes an improved method of lengthening the femur. After a certain period of traction an oblique osteotomy is performed and a stainless steel wire is run through the apposed surfaces of the fragments; a plaster cast is then applied. This method has proved very satisfactory in his hands. The danger of infection is no greater than in any operative procedure, and the occurrence of infection is a reflection on the surgeon's skill and care rather than on the method.

Illustrations showing the exact technique of applying the wire, and roentgenograms of the cases operated on, showing the exact degree of lengthening obtained, are given in the original article. As compared with Putti's method the necessary period of immobilization is reduced by half—from 6 months to 3. AUDREY G. MORGAN, M.D.

Giuntini, L.: Surgical Mobilization of Rigid Joints with Interposition of Absorbable Membranes (La mobilizzazione chirurgica delle rigidità articolari con interposizione di membrane assorbibili). *Chir. org. movim.*, 1946, 30: 216.

Various living tissues, including muscle, aponeurosis, fat, and tendons, have been used in joint surgery to prevent recurrent ankylosis. The author has been experimenting with the use of gelatin for such interpositions. He has used it in experiments on rabbits and describes 2 clinical cases in which it was used, one involving the elbow-joint and the other the ankle. His work is illustrated.

As gelatin is closely related physiochemically to synovial fluid and as it is easy to prepare and apply, it would seem to be the best physiological agent for this purpose. The clinical cases in which the author used it presented absolute rigidity of the involved joint from an old fracture or another injury. The gelatin, which is an organic extract of bone and cartilage, is dissolved in 40 parts of water and boiled for from 45 to 60 minutes until the solvent is completely dissolved. It is then spread on sterile dishes to form a thin layer, and after cooling and condensation this thin layer of gelatin is spread over the bleeding joint surface which has been produced by operation. The gelatin prevents the formation of connective tissue which would reproduce rigidity and the joint remains mobile.

In the author's cases this mobility has persisted for from 4 to 5 months after operation, but it will require more time to tell whether the mobility will remain permanent. If it does, this method of interposition should prove useful in other operations, such as operative elongation of the femur and osteotomy of the neck of the femur for coxa vara or valga, in which it is necessary for the two bone fragments to move on each other. The author knows of no other substance so well adapted to prevent too early fusion as gelatin. AUDREY G. MORGAN, M.D.

FRACTURES AND DISLOCATIONS

Patrick, J.: A Study of Supination and Pronation, with Especial Reference to the Treatment of Forearm Fractures. *J. Bone Surg.*, 1946, 28: 737.

This study is based on 6,000 fractures of the forearm treated during the past 11 years. There are also included nontraumatic cases with limitation of rotation due to other causes: 1,245 cases presenting more than slight limitation of rotation were particularly investigated. Normally, the range of rotation seems to decrease with age, there being a wide variation in the normal range of supination and pronation. Pronation shows the greater individual variation and in normal adults may be as little as 30 degrees. Supination is rarely less than 70 degrees. The interosseous border of the ulna can be regarded as corresponding to the line of the axis of rotation of the radius.

Six hundred and thirty-seven forearm fractures, excluding those with imperfect reduction or malalignment, were studied for the average combined limitation of supination and pronation for fractures of the radius and ulna, respectively, at the different levels, with the exception of some fractures of the head of the radius. Fractures above the level of the interosseous membrane do not cause limitation of rotation after union has occurred. This is true also of fractures of the radial styloid. Cases of Colles' fracture show limitation of rotation.

This problem was investigated by taking arthrograms of the joint space between the head of the ulna and the fibrocartilage. In the fractures with limitation of rotation, some degree of obliteration of this joint space could be demonstrated. Measurements showed that limitation of supination was usually twice as great as limitation of pronation. This degree of limitation is quite unpredictable. There appears to be no relation between the degree of the original displacement and the extent of loss of rotation. Nor does perfect reduction necessarily insure a full return of rotation. Most fractures of the head of the radius produce no limitation of rotation. Even careful excision of the head of the radius gives varying degrees of limitation of rotation.

In fractures of the radius and ulna at the level of attachment of the interosseous membrane there will be some loss of pronation. The restriction of rotation in isolated ulnar fractures is rarely permanent. Callus or fibrous tissue extending into the interosseous membrane from the radius cannot affect the range of rotation of the radius. It was found that the attachments of the articulating discs were torn and caused the disability. Isolated fractures of the shaft of the radius with displacement demand careful treatment. In fractures of the shafts of the radius and ulna above the level of the interosseous membrane there was no loss of supination or pronation after the fractures had united. During the past 5 years, 32 cases of fracture of the head of the radius have been treated by excision with the result that there has been an almost complete return of rotation. Open operation of fracture of the ulna may result in an increase in callus and fibrous tissue around the fracture and, unless absolutely necessary, operation should be avoided. The author incorporates a calico bandage in the last layer of plaster just below the elbow joint and suspension is carried out from this level. With this method, there have been no cases of angulation occurring under plaster.

In cases in which cross union in the lower one-half of the forearm between the radius and ulna have occurred, the treatment consists in excision of 1 inch of the ulna at the site of fracture as well as of the mass of callus between the bones. A full range of supination and pronation is obtained. When cross union has occurred in the middle third of the forearm, treatment is difficult. Here it is necessary to excise 1½ inches of the ulna with callus. After 3 months, a whole thickness fibular graft may be inserted across the gap. When severe permanent limitation of rotation develops after Colles fracture, excision of the head and neck of the ulna is suggested as a reliable way to recover full rotation. Twenty of 24 patients undergoing such operations were finally discharged without any complaint of disability. Volkmann's contracture can be improved by physical therapy.

When there is loss of rotation in paralytic and spastic states, a curvature of the shaft of the ulna may develop. Considerable improvement in the range of rotation can be obtained by performing an osteotomy on the upper third of the ulna and realigning the shaft so that the interosseous border conforms to the axis of rotation of the radius. This is best accomplished by forcing the forearm into full supination or pronation after osteotomy and fixing it in plaster. RICHARD J. BENNETT, JR. M.D.

Murray, G.: End Results of Bone Grafting for Nonunion of the Carpal Navicular. *J. Bone Surg.*, 1946, 28: 749.

The author presents the results in 100 cases in which bone grafts were used for nonunion and fractures of the carpal navicular bone. Excellent results with good function of the wrist were obtained in the majority of the cases.

The author suggests that certain principles must be followed to obtain the best results. The bone graft must be large and well placed so that both fractured fragments are well approximated. The drill hole must be made so that the surrounding articulations are not involved. The fractured fragments must be impacted and the graft so placed that it holds the fractured fragments in good apposition. The spint must include the wrist and all metacarpals, and the proximal phalanges so that the normal movements are completely prevented for a minimum of 10 weeks. Immobilization must be continued until there is x-ray evidence of union of the graft to both fragments. The bone grafts in this series were usually taken from the tibia.

A table is included showing the data on 100 cases of bone grafting for nonunion of the carpal navicular bone. There were 4 cases of nonunion after bone grafting.

The contraindications to bone grafting for nonunion of the navicular are: (1) recent fractures and (2) arthritis in the wrist. Considerable bone grafting of the navicular does not lessen the tendency toward arthritis in the wrist.

The functional end-results in these cases were excellent. RICHARD J. BENNETT, JR., M.D.

Leveuf, J.: Pathological Luxations of the Hip Following Osteoarthritis in Infants (Luxations pathologiques de la lanche consécutives à l'ostéoarthrite du nourrison). *Rev. orthop.*, Par., 1946, 32: 213.

The hip is the joint most frequently involved in osteoarthritis in infants. The disease is generally seen in the first few days or the first few months of life. The author's 14 patients were seen later for the sequelae of the osteoarthritis, that is, dislocation of the joint surfaces. The 14 cases are described and illustrated with roentgenograms.

Operation was performed in all cases as nonoperative reduction is practically impossible in these cases. The causative organism of the osteoarthritis is generally the streptococcus, although some cases have been known to be caused by the staphylococcus aureus. The beginning localization of the disease is in the bone on the metaphyseal side of the joint cartilage.

Ombrédanne and Longuet say that there is luxation in almost all cases, but among the author's 14 cases there were only 2 of luxation and 12 of subluxation. The capsule is generally preserved, which is important in reconstruction of the joint. The acetabulum is preserved and lined with cartilage and frequently contains membranous adhesions. The head and a considerable part of the neck are destroyed.

The author's aim is to restore the reconstructed neck to the acetabulum and provide for its fixation at that point. The steps of the operation are illustrated. A transtrochanteric incision is made and the capsule is incised circularly near the base of the neck. When the joint is opened the adhesions are removed from the acetabulum. The difficult part is the preparation of the upper end of the femur. The chondrophytes which adhere to the stump of the neck are removed and the obliquity of the neck is restored by an incision like that of Whitmena's operation. White wax is used for hemostasis of the bleeding surfaces. The segment of the neck is introduced into the acetabulum in marked abduction. The operation is terminated by careful fixation of the capsule to the base of the neck. The joint is kept in position for about 6 weeks with a plaster cast.

A secondary osteotomy of the neck is performed after about 3 months in cases of subluxation and after from 4 to 6 months in those of complete luxation. In the first case the osteotomy was performed at the time of the first operation but the neck was absorbed, therefore it is performed secondarily now. In some cases the limb had a marked tendency to assume a position of flexion-adduction. In such cases the patient should wear a leather apparatus to keep the hip in good position for about a year. The operation should be performed at an early age, about 3 years. AUDREY G. MORGAN, M.D.

Turner, C. G.: Stable Osteosynthesis. Personal Experience with Kuentscher's Method (La osteosíntesis estable. Experiencia personal con el método de Kuentscher). *Rev. espań. cir.*, 1946, 3: 93.

Kuentscher introduced the so-called nailing of bone-marrow, which employs a steel nail containing 8 per cent of nickel and 18 per cent of chrome. Such a nail does not undergo any changes in the body and is resistant to corrosion. Unlike the nails made of other kinds of steel, such a nail does not produce an electrolytic reaction. The transverse section of the nail is V-shaped. Either straight or curved nails may be used according to the location of the fracture. The function of osteoblasts is not altered by the presence of the nail. Vitallium may also be suitable for such purposes, although it is not as resistant as steel. On the other hand, tantalum, because of its physical properties, cannot be used for bone marrow nailing. Plastic substances, which are derivatives of acrylic resins, are not sufficiently resistant and durable.

A straight nail is applicable when the transverse diameter of the medullary cavity is uniform in the entire bone. This is the case in the diaphysis of the femur. On the other hand, the humerus has the conical shape of the medullary cavity with the narrow side pointing upward; therefore, a nail introduced in the region of the fossa of the olecranon can immobilize sufficiently only a fracture of the lower third of the humerus. In the lower portion of the tibia an hour-

glass constriction of the medullary cavity is usually found and this narrow space interferes with the introduction of the nail.

The V-shaped nail causes only a minimal irritation of the medulla. Usually eosinophilia, more pronounced in children than in adults, follows the introduction of the nail. The sedimentation rate is usually accelerated, but no effect on the amount of hemoglobin or on the number, size, or shape of red or white blood corpuscles could be observed. Eosinophilia is attributable to the irritation of the red bone marrow of the epiphysis in the vicinity of the nail.

There is no unanimity of opinion as to whether the nail favors or inhibits regeneration of bone.

The introduction of the nail is not difficult for an experienced bone surgeon. A strict observance of technical rules laid down by Kuentscher is essential.

The author has never observed fat embolism which was attributable to the introduction of the nail into the bone marrow. Infection of the fracture is possible if strict asepsis is not observed. As a rule such infections are mild because the area is immobilized, the medulla possesses a strong bactericidal action, normal nutritional and circulatory conditions of the involved region are maintained, and the metal apparently inhibits the progress of infection. Lane's technique is advisable, and a local application of sulfathiazole is recommended by the author. Frequently a transient stiffness of the articulation distal to the fracture is observed. Such stiffness as a rule disappears spontaneously within a few weeks. The stiffness may be accompanied by edema and may be interpreted as a reflex sympathetic dystrophy.

The indications for the introduction of the nail are as follows: (1) fractures in patients whose age or general condition make prolonged immobilization undesirable; (2) spontaneous fractures caused by nonmalignant processes; (3) transverse fractures of the diaphysis which frequently show a tendency to lateral displacement; (4) fractures which can be easily reduced but are difficult to maintain in good apposition; (5) fractures of a diaphysis with an annular fragment; (6) fracture dislocations of the neck of the humerus; (7) pseudoarthrosis, fractures with delayed consolidation, and osteotomies; and (8) compound fractures of recent origin.

As to the use of the nail in spontaneous fractures caused by malignant tumors, there is a potential danger of propagation of the tumor due to pressure exerted by the nail on tumor cells.

The nailing favors excellent results in transverse fractures of the middle third of the femur.

The method is contraindicated in infected fractures and those of infancy and adolescence because of the danger of impairment of the functions of the hemopoietic system. JOSEPH K. NARAT, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Stowers, J. M., and Grossman, M. E.: Thrombosis of the Inferior Vena Cava. *Lancet*, Lond., 1946, 2: 868.

The principle of proximal ligation in the treatment of venous thrombosis, whether it be for a spreading thrombophlebitis or a silent phlebothrombosis of the lower limbs, is currently gaining favor. Appropriate ligation of the inferior vena cava for venous thrombosis of the pelvic veins has been recommended by DeBakey and others as a lifesaving procedure in some cases. It combats the chance of pulmonary embolism, or possibly the sudden extension of the thrombus to occlude both renal veins.

Formerly, thrombosis of the inferior vena cava was regarded usually as an incidental happening, difficult to diagnose, and, in any case, of little more than academic interest. The authors believe, however, that thrombosis of the inferior vena cava may be more common than is realized and that great practical surgical importance may now rest upon a reliable method of diagnosis.

The authors describe in detail a technique of phlebography in which a radio-opaque substance, diodone, is injected into one of the tributaries of the saphenous vein near its junction with the femoral vein, and roentgenograms are taken during, and immediately after, the injection. Sensitivity to diodone is carefully determined by either the intradermal method or the ocular method. As a final safeguard, 2 c.c. of diodone are injected intravenously and the patient is observed for untoward reactions.

A neat maneuver, used by the authors, to enhance the radio-opacity of the phlebograms is the employment of a blood pressure cuff below the site of injection, thereby decreasing the dilution of diodone with venous blood from the limb. About 20 c.c. of 70 per cent diodone is injected through an 18 gauge needle in about 20 seconds. Films are taken at 5, 15, 25, and 35 second intervals after initiating the injection.

Two case records are reported in which diodone successfully demonstrated the occlusion of the inferior vena cava. The question of the practical importance and technical performance of this method in the presence of a thrombosis of the inferior vena cava, when it occurs in association with iliac and femoral thrombosis, was not discussed.

EDWARD F. LEWISON, M.D.

Elkin, D. C.: Exposure of Blood Vessels. *J. Am. M. Ass.*, 1946, 132: 421.

The author is desirous of emphasizing the importance of knowing the anatomical relationships of vascular trunks in order to perform operative procedures on the blood vessels intelligently and safely. Adequate exposure is essential but the placing of the skin incision must conform to recognized surgical principles.

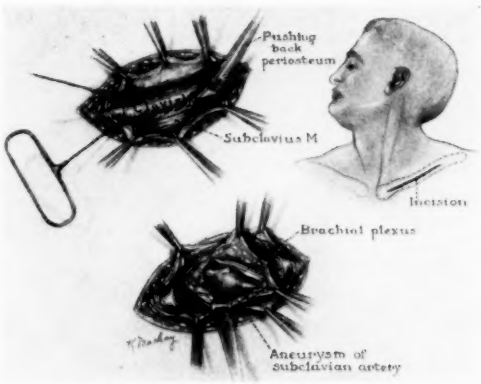

Fig. 1 (D. C. Elkin). Subperiosteal resection of the clavicle for exposure of vessels at the base of the neck.

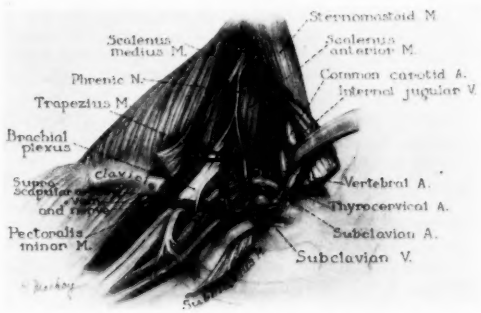

Fig. 2. Exposure of the vessels at the base of the neck. The medial half of the clavicle has been removed. Medial retraction of the carotid sheath exposes the vertebral and thyrocervical vessels at their origin. Further exposure is obtained by dividing the scalenus anterior muscle (after Henry).

The methods of exposure of most of the major vascular trunks are described, with subperiosteal resection of a clavicular segment and of the fibular head to expose the vessels at the base of the neck and the proximal portions of the tibial and peroneal vessels, respectively; it is neither necessary nor advisable to replace these resected segments. The most difficult exposure described is that of the vertebral vessels because of the deep position in which they lie in the neck and because of the vital nature of the surrounding structures. The approach to the vessels lying within the thoracic cage is difficult because of the

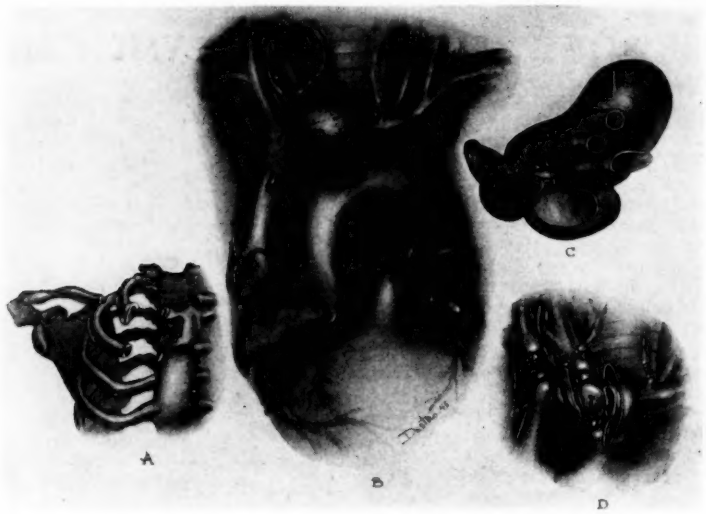

Fig. 3 (D. C. Elkin). Exposure of innominate vessels in case of arteriovenous aneurysm. A portion of the clavicle, first and second ribs and sternum have been removed in A; B shows the fistula with the false venous sac; C is a transverse section showing the false sac and communication between the artery and vein; D shows the vessels ligated and divided.

overlying structures, and the difficulty is enormously increased in the presence of an aneurysm or arteriovenous fistula because of the danger of hemorrhage. The adequate exposure necessary here is gained only by resection of portions of the first and second ribs and of a segment of the sternum in addition to removal of part of the clavicle.

The methods of exposure of the larger vessels in the extremities are also described.

EDWARD H. CAMP, M.D.

Gordon, L. Z., and Thurber, D. C.: Temporal Arteritis; Report of a Case and a Comparison with Respect to Periarteritis Nodosa. *Arch. Path.*, Chic., 1946, 42: 402.

First described in 1932, temporal arteritis has been reported occasionally in the literature as a definite clinical and pathologic entity. A great diversity of symptoms has been described with this condition, including fever, anorexia, malaise, anemia, weight loss, and pain along areas of the temporal arteries and over the scalp, and it has generally been found that the condition is associated with widespread involvement of the arterial tree, the aorta, and the carotid, subclavian, cerebral, and iliac, as well as temporal arteries.

A case of temporal arteritis is described and a pathologic comparison is made between this condition and periarteritis nodosa. The case was that of a 65 year old white laborer whose chief complaint was severe headache and pain over both temporal regions; he further stated that he had had severe pain in his thighs 2 months previously. Thickened, tender, and pulsating temporal vessels were seen. Other findings were negative except for thickened radial and pedal arteries. Temporal pain subsided abruptly on the second hospital day, the constitutional symptoms cleared, and 8 months later when the patient was seen he was asymptomatic. A biopsy of the temporal arteries on the fourth hospital day revealed that the walls were thickened and infiltrated with lymphoid cells, the internal elastic membrane was reduplicated, pigmented, and destroyed in places, and the media was edematous and infiltrated with lymphocytes and plasma cells with occasional small areas of necrosis. The specimen had the appearance of a granulomatous lesion. It was concluded that the patient had suffered from a generalized arteritis, with progressive involvement of different arteries.

The authors concluded from a review of the literature and their own findings that every histologic picture described in temporal arteritis so far can be found in periarteritis nodosa. It is impossible to differentiate the two conditions on the basis of cellular responses; both conditions go through destructive and reparative phases which are similar. The statement that there is specifically an axial spread in temporal arteritis and a local lesion in periarteritis nodosa has been controverted in many instances.

The differences between temporal arteritis and periarteritis nodosa are as follows: (1) periarteritis nodosa involves the visceral and only less commonly

a few of the medium sized and smaller peripheral arteries; temporal arteritis has its predominant involvement in the aorta and in its larger branches (innominate, carotid, subclavian, iliac, as well as the temporal arteries); (2) temporal arteritis is observed twice as frequently in women as in men; (3) temporal arteritis has never been reported in anyone under 55 years of age, whereas periarteritis nodosa is most frequent in young adult males; and (4) periarteritis nodosa is usually fatal, whereas patients with temporal arteritis usually recover.

Periarteritis nodosa is called a misnomer by the authors, as occasionally the nodose character of the lesion is absent. Temporal arteritis is also incorrectly named, as, often, the involvement is not limited to the temporal arteries and, on occasion, the temporal arteries may not be involved. It is suggested that periarteritis nodosa be called "panarteritis predominately of the visceral arteries," and that temporal arteritis be called "panarteritis predominately of the aorta and its peripheral branches."

PHILIP B. CHASE, M.D.

BLOOD; TRANSFUSION

Lefébure, F.: Transfusion and Autotransfusion of Oxygenated Blood in the Treatment of Asphyxia, Electrocution, Drowning, and Carbon Monoxide Poisoning (La transfusion et l'autotransfusion oxygénée dans le traitement des asphyxies, électrocutions, noyades et intoxications par l'oxyde de carbone). *Presse méd.*, 1946, 54: 833.

In cases of asphyxia, artificial respiration often fails for two reasons:

1. In many cases, especially in drowning, the lower portion of the respiratory tract is obstructed because of the aspiration of water or other substances and the walls of the alveoli are adherent to each other like two sheets of wet blotting paper; this prevents the oxygen from passing into the lung capillaries.

2. Even if the lower respiratory tract is free and oxygenation of the pulmonal blood by artificial respiration is possible, this blood does not circulate in the systemic circulation when the heart has stopped beating, as in electrocution or reflex collapse.

In these conditions, it appears more rational to inject oxygenated blood directly into the heart, rather than to try artificial respiration. The author experimented on cats which were kept under water for different periods up to 30 minutes. Then the thorax was opened for observation of the heart and a few cubic centimeters of oxygenated blood were injected intracardially. In all of the cases the heart started contracting again, the cyanotic color of the muscle changed to bright red, and systemic circulation could be observed. After the oxygen had been exhausted, the contractions stopped. This experiment can be repeated any number of times in the same individual.

On the basis of these experiences, the author developed the following routine for the purpose of resuscitation:

Oxygenated blood is injected intracardially. One minute later, the cardiac muscle is stimulated electrically. This proceeding is repeated in the same order until contractions of the heart set in. After the beginning of heart pulsation, the injection of oxygenated blood is continued by the intravenous way. The blood is supplied either by heterotransfusion or autotransfusion. The latter method is preferable, except for cases of severe hemorrhage, as the amount of available blood is not limited. The blood is drawn from the femoral vein and passed through the oxygenating apparatus before being reinjected either in the heart muscle or in the vein. The author considers this as the method of choice in all cases in which the cardiac muscle is in a condition of asphyxia without lesion of an organ (electrocution, syncope during anesthesia).

The treatment of carbon monoxide poisoning by autotransfusion presents a special problem. Since the affinity of carbon monoxide to hemoglobin is 210 times greater than that of oxygen, blood which had been exposed to carbon monoxide cannot be oxygenated in the usual oxygenation apparatus. To substitute the oxygen for the carbon dioxide, oxygen has to be brought in contact with the blood under high pressure. The development of this method is still in the experimental stage and has not been applied to clinical cases.

Altogether it seems that the work of the author has not gone beyond the stage of animal experiments since he does not mention any experiences with cases of asphyxia in man. He reports, however, that Vladimir Negovsky in Russia has developed a similar method which was applied successfully to wounded soldiers. Of 51 patients who were considered lost, 12 were resuscitated by autotransfusion of oxygenated blood.

WERNER M. SOLMITZ, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Baronofsky, I. D., Treloar, A. E., and Wangensteen, O. H.: Blood Loss in Operations: A Statistical Comparison of Losses as Determined by the Gravimetric and Colorimetric Methods. *Surgery*, 1946, 20: 761.

Earlier methods for the determination of blood loss in operations involved colorimetric estimations by the acid-hematin method of blood washings from sponges, linens, and instruments. The latter test could be done only after the completion of the operation. Further, there was no direct correlation between the amount of blood lost and changes in hematocrit, hemoglobin, and plasma protein concentration.

In the present investigation, the blood loss from various operations was determined by the gravimetric method by means of a small weighing scale used directly in the operating room. Only dry sponges were used. The average weight of a 4 by 8 centimeter Curity x-ray sponge was 6 grams, and that of the laparotomy ring sponge, 28 grams.

The results from the gravimetric method were compared with those obtained by the colorimetric method. The average blood loss during appendectomy was 25.8 c.c., during hernia, 82.9 c.c., during gall bladder operation, 179.4 c.c., subtotal gastrectomy 456 to 500 c.c., thyroidectomy, 406 c.c., and pneumonectomy 1,543 c.c. Comparison with the colorimetric method showed good agreement between the two tests.

BENJAMIN G. P. SHAFIROFF, M.D.

Abbott, W. E.: Chemical Alterations Occurring in the Surgical Patient, and Their Interpretations. *Surgery*, 1946, 20: 770.

Methods for the correction of the chemical and physiologic disturbances in the sick and injured are not dependent on the accumulation of a large variety of laboratory data, but rather on the proper clinical interpretation of the metabolic disturbance. Although there are accurate chemical methods for the estimation of hemoglobin, cell volume, specific gravity of the blood and plasma, protein, etc., such values may become misleading especially when they are not paralleled by estimations of the circulating blood volume. It has been demonstrated that normal hematocrit values in males may vary between 41.8 and 52.4. Blood studies often yield normal values in spite of obvious clinical states of malnutrition or dehydration.

In a study of 6 cases of gastric obstruction, hematocrit and plasma protein values were within normal limits but the plasma volume was subnormal and masked, by this dehydration, a reduced cell mass and a low total circulating protein. Postoperative edema, either the local or general type, is related to a variety of factors such as protein depletion, particularly of the albumin fraction, increased filtration pressure, increased capillary permeability, loss of tissue elasticity, kidney or endocrine dysfunction, lymphatic obstruction, or postoperative salt intolerance. The administration of isotonic salt solution is often undesirable because a greater percentage of the ingested water is excreted, thus creating a hypertonic extracellular phase of salt which in turn causes the withdrawal of water from the cell. Such salt intolerance may result in death due to pulmonary or cerebral edema. The administration of half strength isotonic solution may produce a hypotonic extracellular phase with a shift of water to the intracellular depots.

Normal plasma chloride or sodium concentrations may be obtained both in the state of dehydration and in overhydrated patients. Proof was presented that the degree of hydration or deficiencies of sodium chloride could not be determined from a plasma chloride estimation. Edema may appear in patients with a normal plasma protein concentration, yet it may fail to appear in others with a low plasma protein concentration, showing that water and salt consumption are equally important in the process of edema formation. In intestinal obstruction, dehydration and plasma volume reduction follows as a consequence of a reduced intake of fluid plus the loss of fluid by vomiting, distention, hemorrhage, transudation, and infection. The prerenal azotemia or elevated urea nitrogen of intestinal obstruction is due to the lack of fluid necessary for the excretion of nitrogenous end products. In such cases 4,000 to 5,000 c.c. of 10 per cent glucose in distilled water may be necessary to carry off the products of nitrogenous breakdown.

The author emphasizes that parenteral therapy should be dependent on the findings of a careful physical examination and the logical interpretation of a detailed history. In addition, blood chemistry, an accurate record of intake and ouput, plus the determination of the specific gravity, the chlorides, and the nitrogen in a 24 hour sample of urine, will serve to direct the kind and quantity of fluid the patient needs.

BENJAMIN G. P. SHAFIROFF, M.D.

Gibbon, J. H., Jr., and Freeman, L. W.: The Primary Closure of Decubitus Ulcers. *Ann. Surg.*, 1946, 124: 1148.

The surgical problem presented by a large decubitus ulcer is similar in many respects to a third-degree burn with a full thickness skin loss. The end results of spontaneous healing and skin grafting are unsatisfactory because they do not provide full thickness skin and subcutaneous tissue over bony prominences.

A method of operative closure of decubitus ulcers is described. It involves: (1) complete excision of the ulcer, its margin, and all pockets without contamination of the wound; (2) the formation of skin flaps in the immediate vicinity with curved borders and broad bases; (3) the rotation and advancement

of these flaps to cover the skin defect without tension; and (4) the use of very fine cotton thread for suture material.

Sixty-five ulcers were operated upon by this method in 43 patients. Primary healing took place in 44, or 68 per cent, but the results could be regarded as satisfactory in 59, or 90 per cent.

The author believes that complete excision and immediate plastic closure is the best method of treating bedsores in young patients with paraplegia.

EMIL C. ROBITSHEK, M.D.

Fontaine, R., and Greiner-Oswald, A.: Diagnosis of Pulmonary Embolism, and Its Treatment Except by the Method of Pulmonary Embolectomy (Identification et traitement des embolies pulmonaires, l'embolectomie pulmonaire exceptée). *J. chir.*, Par., 1946, 62: 249.

Extensive animal experiments are described which show that massive pulmonary embolism with obstruction of the trunk of the pulmonary artery, as described by classical writers, really exists and that it is found in approximately two-thirds of the cases terminating in sudden death. However, in about a third of the cases with rapid death obliteration of the circulation had not occurred in enough of the lung surface to cause death in itself. The cause of death in massive pulmonary embolism is not entirely mechanical; death is partly due to reflexes originating in the endothelium of the vessels and bringing about vasoconstriction and dilatation of the right side of the heart with stagnation of the blood in it.

The embolism may represent the whole of the venous thrombus. Such thrombi are brought about by slowing of the circulation, changes in the walls of the veins, and changes in the blood. Surgery tends to bring about such changes in the blood that it is not astonishing that postoperative embolism occurs but that it does not occur more frequently. Whether or not a thrombus breaks off and forms an embolism depends to a great degree on the rapidity of retraction of the clot; an excess of platelets favors retraction and therefore embolism. If the exact physicochemical changes in the blood could be determined and prevented it would be possible to prevent embolism entirely.

There are four typical forms of clinical picture in acute embolism: the syncopal form, the form accompanied by anguish, the form with cardiovascular collapse, and the form with respiratory asphyxia. Diagnosis is not too difficult in these classical forms but there are atypical forms with hemiplegia or peritoneal syndromes in which diagnosis is very difficult. Most of the mistakes in diagnosis are made in these forms.

As to treatment, the author does not discuss the only really curative treatment, pulmonary embolectomy, as this is to be discussed by Redon in another article. The prevention of venous thrombosis requires careful and delicate handling in surgical operations. Factors which tend to prevent venous stasis are early exercise in bed, massage, and elevation of the foot of the bed. Early rising activates the circulation in the lower limbs and in this way combats one of the factors of postoperative thrombosis. Preoperative surgical treatment of varices reduces stasis. Hypercoagulability of the blood may be treated with heparin and the derivatives of coumarin. However, none of these methods is absolutely effective. Once thrombosis has developed an effort may be made to prevent embolism by ligating the vein in front of the embolus, by phlebectomy (excising the obliterated segment of the vein), or by thrombectomy. Villaret, Justin, Besancon, and Bardin use ephedrine for its action on the sympathetic system, neutral atropine sulphate as a vagolytic drug, and bicarbonate of soda for alkalinization.

When pulmonary embolism has developed, analgesic drugs, to quiet the patient's excitement, heart tonics, excluding digitalis, and papaverin, as a peripheral vasodilator, should be given to the patient. Minor surgical procedures may be used, such as infiltration of the stellate ganglion and intravenous and intrapleural injections of novocain.

AUDREY G. MORGAN, M.D.

Redon, H.: The Surgical Treatment of Pulmonary Embolism (Traitement chirurgical de l'embolie pulmonaire). *J. chir.*, Par., 1946, 62: 267.

The idea of opening the pulmonary artery and extracting an obstructing embolus was conceived first by Trendenlenburg in 1907. Up to 1939, 130 cases have been published, 12 of which were successful. Probably, the true mortality rate is even higher since many unsuccessful operations may not have been published. In view of this high mortality, many surgeons are pessimistic and hesitate to operate at all; however, it should be possible to decrease the mortality rate under three conditions: precise indication, perfect organization, and impeccable operative technique.

The time between the occurrence of a massive embolism of the pulmonary artery or one of its main branches and death is between 30 and 45 minutes on the average; however, this time may frequently be prolonged to several hours. As some patients survive without operation, the surgeon should be ready for operation at shortest notice but should wait at the bedside, sometimes for hours, and decide on operating only "when the patient begins to die." Perfect organization means that a surgeon trained and experienced in embolectomy should be available on shortest notice, i.e., within 20 or 25 minutes, and that the equipment should be complete and always ready for use.

The technique follows more or less the original concept of Trendelenburg:

A T-shaped incision is made along the left sternal margin and parallel to the second rib. The second and third costal cartilages are resected close to the sternum and the second and third ribs 6 or 8 cm. laterally. The left border of the sternum is resected to a width of 2 cm. to avoid opening of the pleural cavity. The pericardium is opened at the inferior angle

of the incision. The artery is visualized and opened by a longitudinal incision of 2 cm. and the embolus is extracted by forceps, both main branches of the artery being explored. It is vital to operate at highest speed to avoid damage to the nervous centers; the artery should not be clamped for more than 45 seconds.

Two grave errors which have proved fatal in a number of cases must be avoided: one is the accidental opening of the left pleural cavity, which may cause death by pleural shock, and the other is mistaking the aorta for the pulmonary artery, which has been done even by outstanding surgeons.

The postoperative complications include suppurative pericarditis or mediastinitis, and damage to the cerebral centers (amaurosis, aphasia). The danger of a second embolism after a longer or shorter interval is always present and should be prevented by ligation of the thrombosed vein. One case is on record in which embolectomy was done successfully twice in the same patient. WERNER M. SOLMITZ, M.D.

Padgett, E. C.: Indications for Determination of the Thickness for Split Skin Grafts. *Am. J. Surg.*, 1946, 72: 683.

In skin grafting it is a truism that the advantageous properties of a skin graft are in proportion to the thickness of the graft, provided a "take" can be obtained. Conversely, the disadvantageous properties are in proportion to the thinness of the graft, except that a "take" is more assured.

It is obvious then that a skin graft cut at a uniform thickness has positive advantages.

Padgett classifies these sheet skin grafts into four types:

1. Thiersch. (Thiersch's original description of his graft as containing only the epithelial layer probably never was nor can be cut; there is always some corium.) This graft is cut from a thickness of about 0.008 (0.2 mm.) to 0.10 of an inch (0.25 mm.).

2. Superficial and intermediate "split skin" graft (Blair *et al.*) This is from one-third to two-thirds of the skin depth, in adults usually from 0.012 (0.3 mm.) to 0.016 of an inch (0.4 mm.).

3. The so-called "three-quarter thickness" skin graft. This is cut from 75 to 90 per cent of the skin depth, from 0.018 (0.5 mm.) to 0.022 of an inch (0.6 mm.).

4. The full thickness skin graft. This includes all skin layers and varies from about 0.030 (0.88 mm.) to 0.038 of an inch (1 mm.).

The following factor has to be considered when the type of skin graft to be used is selected: is the base granulating or freshly denuded? In addition, the location of the recipient area, the age of the patient, the donor area and recipient areas difficult to cover with skin are important considerations.

Lesions for which skin grafts are particularly applicable are the granulating, more or less superficial, relatively nonaseptic areas (whatever their cause may be), and the healed or nearly healed cicatricial contractured lesions due to various causes which when excised or cross-cut provide an aseptic base. To resurface the former in an adult, a thin skin graft from 0.008 to 0.10 of an inch in thickness is used. To resurface and correct the latter a "three-quarter thickness skin graft," with certain exceptions, is best.

The author reviews various lesions and states the type of graft best suited for each. These include the unhealed and the healed lesion following severe burns, birthmarks, and cavities. He also discusses the making of an artificial vagina, urethra, and eyebrows, and the correction of webbed fingers.

STEPHEN A. ZIEMAN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Hindmarsh, J., Melin, G., and Melin, K.-A.: Accidents in Childhood. *Acta chir. scand.*, 1946, 94: 483.

The authors present an analysis of 5,083 accidental injuries in childhood. The injuries occurred during the period from 1930 to 1940, and were treated in an urban and a rural hospital in Sweden.

The majority of the patients were boys, the number of girls being at times only one-half or one-third that of the boys. The accidents had occurred with greater frequency during the first 3 years of life, and the majority of accidents took place during the warmer seasons.

The mortality was low; only 22 of the children died. The children who managed to overcome the first shock seemed to have a distinctly greater capacity for recovery than adults. In the fatal cases death was due to injuries of the cerebrum and abdomen, to burns, and (in 1 case) to a fracture. A number of serious accidents in children never reach the hospital.

During early infancy, accidents occur in most cases without the co-operation of the child. Examples of such accidents were falls from weighing machines and tables (14 cases), and dropping when moved (6 cases). Cranial injuries resulted in 15 of these 20 children. The remaining 5 children sustained fractures of one of the bones of the lower extremities.

During infancy, and in children from 2 to 6 years, burns predominated (315 cases, or 6.2 per cent of the total number of accidents). The causes of burns were as follows: scalding with hot fluids (236 cases), contact with hot metal (33 cases), exposure to chemicals (19 cases), contact with fire (15 cases), and electrical contacts with high voltage current (8 cases).

During the transition to the age of playing, the child enters a period of pronounced curiosity with regard to its surroundings. In 195 cases objects became lodged in the respiratory or digestive tracts. Of the 186 known objects, 147 (79 per cent) were metallic—61 sharp (screws, nails, pins, needles, etc.) and 86 blunt (metal balls, closed safety pins, toy parts, and coins). The 39 nonmetallic objects included pieces of glass, celluloid bits, fish bones, toy parts, glass balls, etc. The foreign body was stuck

in the mouth in 2 cases, and in the pharynx in 12 cases; in the former, large objects, and in the latter, thin, sharp objects. Only in 1 case had the foreign body found its way into the respiratory organs. Generally, coins were impacted in the esophagus (16 cases). In 55 children objects were stuck into the nose, and in 5 cases in the external auditory canal.

Swallowing of corrosive fluids was observed in 19 cases. Nine of the children were 1 year of age, and the remainder from 2 to 4 years. Acid was the cause once, while in the remaining 18 cases lye was the injurious agent. In the event of a substance containing lye powder, the injuries were generally superficial, but extensive corrosion injuries appeared from strong solutions. There were 57 injuries of intoxication, from the consuming of too easily accessible medicines in 23 cases, chemical washing solutions in 17 cases, diluted, noncorrosive acids or alkalis in 8 cases, water colors and colored chalks in 6 cases, and cigarette ends in 3 cases.

Thirty-three children sustained injuries from falling with a stick or similar object in the mouth.

Falls out of bed or perambulators are reported in 115 children, 56 of them infants. Fractures occurred in 55 of these. In 9 cases concussion of the brain was noted. The injuries usually occurred in the upper half of the body, 39 being localized to the head, 62 to the upper extremity, and 5 to the upper part of the trunk. Only 9 were noted in the lower extremity.

Falls from a window or balcony occurred in 49 children. Fractures, often multiple, followed in 32 cases. Nine of the children were 10 to 12 years of age, the rest being 5 years, or younger. Falls from a staircase occurred in 150 children. In 57 of these a fracture ensued, frequently being a fracture of the clavicle. Concussion of the brain resulted in 28 cases. Injuries due to slamming doors occurred in 21 children. The injuries were localized either to the hand or the leg; they were usually wounds and contusions, and occasionally fractures.

As the result of an adult pulling the arm of a falling child, damage to the shoulder or elbow joints may result, represented either by a subluxation of the head of the radius or a distortion in the elbow joint. Injuries of these types occurred in 116 children.

Seventy-three children sustained injuries caused by playing in swings, and climbing stands. Fractures resulted in 26 cases, and concussions of the brain in 8 cases. The remaining children had wounds and contusions.

One hundred and thirty children had injuries from bites—69 insect bites and 39 dog bites. The former do not, in the majority of cases, cause any serious injuries. The effect of the dog bites has been of a more serious kind, invariably involving great risk of infection. The latter caused a prolonged and complicated course of healing and ugly scar formation. Dog bites of the head occurred in 16 children, most often in the face, and dog bites of the upper extremity occurred in 13 cases, most frequently in the hand. Adder bites were reported in 15 children, 14 of whom received serum.

Thirty-one cases of self-inflicted bites of the mouth after falls were noted, all of them uncomplicated.

When the child reaches school age, gymnastics and sports entered into the cases of accidents. There were 52 accidents occurring during gymnastics, 16 during athletics, and 33 during sports. Fractures resulted in 47 cases, contusions in 17 cases, and concussions of the brain in only 4 cases.

As a result of winter sports, 177 children were injured, the younger while sledding and the older while skiing or skating. At tobogganing, 59 children were injured, head and leg injuries predominating. Ten fractures of the femur and 15 fractures of the leg occurred. Fifty-five children were injured while skating. In 22 of these, the injuries were to the arm. Injuries of the leg were common, and of the thigh, rare. Accidents while skating are a most common cause of concussion of the brain, 15 cases having been noted. Injuries of the extremities, often fractures, occurred in 40 children as a result of skating accidents.

Traffic accidents account for an important group of childhood injuries. Among pedestrians of all ages, who have been subjected to traffic accidents by daylight, those in the age group of 0 to 10 years suffer the maximum number of accidents; the age group from 10 to 12 years are shown to have the lowest number. Traffic accidents numbered 461 (9.1 per cent of the total number of accidents). After the small number of traffic accidents in infancy, a noticeable rise was seen in the 2 year age group, which became marked in children between the ages of 3 to 7 years, in which group 48.4 per cent of the total number were found. Children in the 6 year age group were the principal sufferers of these accidents. Bicycle accidents were the cause of injury in 242 children, followed by motor car accidents in 198 cases, the latter causing the more serious injuries. Of the 461 children in traffic accidents, 337 (73.1 per cent) had to be admitted to the hospital for treatment.

Narrow escapes from drowning are common in childhood, but the children do not usually get to a hospital. All but 3 of the children in this group were seriously affected.

In the material from the country hospital, 15.3 per cent of the children were injured in the performance of household duties.

The authors recommend antitetanus vaccination for children with lacerations in which there is danger of infection; or, better, a combination of diphtheria and antitetanus vaccination of all children. In the present series there were 1,067 such cases.

Fractures occurred in 1,336 instances, usually in the upper or lower extremities. Fractures of the skull were found in 118 of the 295 children in whom roentgenograms of the skull were made. Three of these children died. Only 7 of the children had fractures of the base of the skull. A depressed fracture of the roof was noted in 18 children, but only 6 of these children were operated upon. Patients with cranial fractures were treated by rest in bed for at least 1 month, while those with simple concussion

were kept in the hospital for 1 week and at home for 1 week.

The mortality from burns was 4.7 per cent, all the deaths occurring in children under 5 years of age. The authors recommend the tannic acid treatment of burns and advise the earlier use of skin grafts.

Foreign bodies in the intestinal tract of children were passed 68 times in from 1 to 22 days. Surgical removal was undertaken in 16 children. Eight coins in the esophagus were removed by the esophagoscope. The remaining 8 objects (1 coin, 3 pins, 2 nails, and 2 hair clasps) required removal by opening of the stomach or duodenum. The curves of the duodenum may present difficulties for the passage of foreign bodies.

Prophylactic measures against accidents in childhood are discussed, viz., the prevention of burns, the isolation of corrosive fluids, medications and poisons in homes, the control of inferior electrical equipment, the sensible choice of toys, the fixing of window catches, gratings, and balconies, the supervision of play apparatus, the education of children to traffic, the withholding of bicycles until the age of 10 to 12 years, and the institution of social reforms.

ERNEST E. ARNHEIM, M.D.

Perves, J., Barge, P., Parneix, H., and André, J.: Accidents following Prolonged Compression of the Muscles of the Limbs (Accidents consécutifs à la compression prolongée des masses musculaires des membres). *Rev. méd. navale*, 1946, 1: 73.

In July, 1944 the inhabitants of a small French town ran into a tunnel to escape an air bombardment. After a little while the individuals at the back of the tunnel had difficulty in breathing and pushed toward the opening. They were crowded close together and could only move slowly in the darkness. Some of them fell and others stumbled and fell over them until there was a pile of bodies 3 meters high blocking the tunnel for 10 meters. The bodies were so entangled that it was hard to get them out. There were 80 dead and more than 100 wounded.

The authors had occasion to treat 14 of these patients. There were 5 with very severe conditions resulting in 2 deaths, 1 with a moderately severe condition, and 8 with mild conditions. Details of the cases are given. When the patients were brought out of the tunnel, where they had been for from 3 to 5 hours, their muscles, especially those of the legs, were very much swollen and very hard. The skin was livid and cold, with dilated veins. Some of the patients were in a state of shock and most of them said they were in great pain. The urine was scant and very dark. There was evidently a relationship between the contusion of the muscles and the hemoglobinuria or hematuria.

The authors did not know, at the time, of the English work on this crush syndrome, or Bywaters syndrome, as it has been named from its first investigator. They concluded that the prolonged compression of the muscles caused capillary hemorrhage and edema. This increase in volume, added to the external violence, brought about complete disintegration of the muscles, which was followed by fibrosis. They believe that the hematuric nephritis and the degeneration of the liver seen in 2 cases were toxic in origin and that the shock also was largely due to intoxication. They do not attempt to explain the labial herpes which occurred in 5 of the cases. English authors advise the application of a tourniquet to the injured limbs and keeping them cold to prevent dissemination of the toxin. The authors gave adrenalized serum intravenously for the shock and infiltrated the sympathetic nerve with novocain. Transfusion did not seem to be indicated. They used bicarbonated serum for the acidosis to prevent the precipitation of hematin. They used hypertonic glucose solution and insulin in preference to hypertonic salt solution. They performed decapsulation of the kidneys in 1 case, but it was too late; the intoxication was far too advanced. In future, they will do early decapsulation.

In the discussion, GOSSET said that he thought too much importance had been attributed to intoxication as the cause of these phenomena. They are like those produced when a tourniquet is applied to a limb and ischemia is produced. When the tourniquet is removed, the blood rushes in and causes edema; this decreases the volume of circulating blood and explains the initial shock, which is not toxic but circulatory. PERVES replied that it was hard to believe that the total disintegration of muscle in these cases did not result in toxic products which were carried into the body, particularly the kidneys and liver.

AUDREY G. MORGAN, M.D.

Graham, J. R., and Scott, T. McN.: Notes on the Treatment of Tetanus. *New England J. M.*, 1946, 235: 846.

The incidence of tetanus among American forces during World War II was very low: only 1 case had been reported up to February 1, 1945 in troops of the European Theater. In the German Army, active immunization with tetanus toxoid was given only to a selected few. Consequently tetanus was frequently encountered in German prisoner casualties treated in American Army hospitals. The authors report 10 cases of tetanus that developed in 3,507 sick and wounded German prisoners treated at an overseas station hospital during the period between September, 1944 and March, 1945.

Incubation periods ranged from 5 to 22 days, with an average of slightly more than 10 days. Of the 10 patients, 4 died, all within less than 10 days of the onset of the disease, but 3 of the 6 survivors had incubation periods of 10, 8, and 5 days. None of the patients had had adequate prophylaxis, judging from available records. Tetanus toxoid does not benefit a patient who has not been previously immunized, for the development of antibodies is too slow to prevent the disease. Fifteen hundred units (American) of antitoxin should be given on the day of wounding and repeated every 7 days, as the passive immunity lasts only from 7 to 14 days. The fact that 9 of the

10 patients had received large doses of chemotherapeutic agents (one patient had been given 1,000,000 units of penicillin and 30 grams of sulfadiazine) prior to the onset of symptoms suggests that these agents will not prevent the disease.

In outlining the signs and symptoms of classic generalized tetanus and of local tetanus the authors emphasize that the most important step in making the diagnosis is to think of the possibility of tetanus.

The treatment of the disease is a major undertaking. The patient should have his own room and special attendants at all times. Usually he will require redébridement of his wound. Radical wound excision eliminates the focus of further toxin formation. Subsequent to the operation all attentions to the patient should be arranged on a schedule at three-hour intervals, to minimize the disturbance to his rest. These ministrations will include the giving of sedation and penicillin, feeding, back massage, postural changes. Sufficient antitoxin should be given to neutralize the toxin already produced. In the authors' experience this was 120,000 to 180,000 units, of which 20,000 to 40,000 units were given intravenously. Increased metabolic requirements may be met by using a stomach tube (left in place 5 to 6 days) to introduce a daily diet of 3,000 to 3,500 calories containing 120 to 130 grams of protein in 3,500 to 4,000 c.c. of fluid. Sedation must be balanced between the danger of spasms and convulsions resulting from inadequate sedation, and the danger of pulmonary complications, the result of oversedation. The authors achieved this balance by using from 4 to 6 c.c. of paraldehyde or 0.2 gm. of sodium amytal orally every 3 hours. Either may be given intravenously for emergency sedation.

Sulfadiazine and penicillin are effective in preventing wound infection and pulmonary infection subsequent to atelectasis, which was an almost universal complication in the authors' cases. Their treatment of atelectasis included voluntary coughing, frequent changes of position, postural drainage, carbon dioxide-oxygen inhalations, and slaps on the back to loosen mucus plugs. To avoid excretory complications, they advocate the routine use of mineral oil as a prophylaxis against fecal impaction and the placing of indwelling catheters to prevent urinary retention secondary to sphincter spasm.

B. F. Lounsbury, M.D.

De Lavergne, V., Helluy, J., and Faivre, G.: The Ineffectiveness of Local Surgical Treatment in Manifest Tetanus (De l'inutilité du traitement chirurgical local dans le tétanos déclaré). *Presse méd.*, 1946, 54: 602.

Larrey first recommended amputation of the injured limb in manifest tetanus, and at the meeting of the Surgical Society in 1928 the physicians and surgeons present were almost unanimous in their opinion that surgery should be practiced. Small series of statistics were presented to prove this point, but it is well known that there are many sources of error in small series of statistics.

The statistics of the authors' own clinic show that the results are rather better in nonoperative than in operative cases, and the difference is still more apparent in cases of postabortion tetanus. The argument for local operation was that the spores and bacilli were removed and this prevented the formation of toxin. However, it has been shown that the bacilli do not remain localized at the portal of entry. They have been found on compresses placed on the operative wound, which shows that they exist in tissues at a considerable distance from the portal of entry.

Surgery has never been recommended in diphtheria. It is true that antitoxin is more effective in diphtheria than in tetanus. This is because the angina of diphtheria develops while the toxin is still free and indicates merely the portal of entry, while trismus in tetanus does not develop until the toxin has been fixed at a distance. There are no clinical symptoms in tetanus at a stage corresponding to the angina of diphtheria. In tetanus, anatoxin should be given in addition to antitoxic serum, for while the former does not destroy tetanus toxin it protects the patient from further injury by destroying the remaining spores and bacilli. Audrey G. Morgan, M.D.

Sulamaa, M.: Concerning the Mechanism of Infection in Chronic Recurrent Staphlococcal Diseases. A Special Clinical Bacteriological Investigation of Furunculosis and Its Complications (Ueber den Infektionsmechanismus bei chronisch rezidivierenden Staphylokokkenkrankheiten. Eine klinisch-bakteriologische Untersuchung speziell ueber die Furunkulose und ihre Komplikationen). *Acta chir. scand.*, 1946, 94: 291.

Chronic staphylococcal skin infections have been more frequent in Finland during the war years. In order to gain a better understanding of these cases the mechanism of infection was investigated in its bacteriological and clinical aspects. Of especial interest to the author was the problem of pathogenicity of various strains of staphylococci. Likewise, he was interested in determining whether recurrent infections in the same individual represented reinfection with the same bacterial strain or whether the recurrences represented new infection with other strains. The following criteria of pathogenicity were used: pigment formation, production of hemolysin, formation of plasma coagulase, and destruction of mannitol.

One hundred healthy patients were studied. Sixty-six staphylococcal strains were recovered from the skin and 64 strains from the nasal secretions. Specimens were taken from pus in 150 acute infections. Twenty-one per cent of the skin strains were pathogenic according to 2 of 3, or 3 of 4 criteria. Similarly, 46 per cent of those from the nasal secretions and 93 per cent from pus were pathogenic. None of the criteria of pathogenicity were found among 57 per cent of the skin organisms, 41 per cent of the nasal staphylococci, and 4 per cent of the organisms taken from pus. The remainder were not definitely in either category.

Sixty patients with relapsing staphyloderma were studied; 47 were males and 13 females. Sixty per cent of the cases occurred in apparently healthy individuals and consisted of typical recurrent furunculosis. The other 40 per cent were associated with fairly obvious predisposing factors such as diabetes, pseudodiabetes, malnutrition, or local disturbances. These included such cases as multiple furunculosis, carbunculosis, bullous or impetiginous staphyloderma, and similar disorders with defective healing and a tendency to become chronic.

In vitro tests were performed in staphylococcal infections of long standing. The organisms isolated seemed to be somewhat more pathogenic than those taken from acute pyogenic infections. Cultures taken from several lesions at different times in multiple furunculosis showed only one strain in one and the same patient. In about half of the patients with furuncles the same organism was present in the nose and on healthy skin, suggesting that the skin and mucous membrane were the sources of reinfection. Many patients with obvious low resistance were infected with strains which seemed relatively nonpathogenic in vitro.

In conclusion, the author advises surgical incision of furuncles and radical excision of carbuncles except on the face. To cope with recurrences he suggests careful asepsis in handling, local applications of antiseptics to the skin, and chemotherapy. He is uncertain about the value of polyvalent vaccine. Obvious causes of decreased general resistance such as diabetes or cachexia are corrected.

THEODORE B. MASSELL, M.D.

Govan, A. D. T.: An Account of the Pathology of Some Cases of Clostridium Welchii Infection. *J. Path. Bact.*, Lond., 1946, 58: 423.

The first portion of the present article is concerned with a description of the local pathological changes in gas gangrene, based on 120 muscle biopsies from service casualties. Immediately adjacent to the wound surface is a zone of necrosis involving all structural elements, considered by the author to be due to the original unjury. Peripheral to this zone is an area of marked edema in which the muscle fibers are widely separated from each other; there is beginning loss of muscle striation, and degenerative changes in the nuclei are moderately advanced. This zone merges into a more peripheral one in which the edema is accompanied by intense vascular congestion and the muscle shows fewer evidences of degenerative change. Extreme vasodilatation and extensive hemorrhage is present, and many vessels are thrombosed. The author stresses the significance of the thrombotic phenomenon in this zone as he believes that this is a primary cause for the characteristic necrotic changes of Clostridium welchii infection.

The second portion of the article deals with material drawn from post mortem examinations in 3 cases of severe Clostridium welchii infection. In all 3 of the cases diffuse fat emboli were found to form a significant part of the post mortem picture. Fat emboli were prominent in the lungs and in the central nervous system; fat emboli were demonstrated in the optic nerves of 1 patient in whom blindness had appeared before death.

Experimental work is quoted, in which the injection of Clostridium welchii toxin into the thigh muscles of guinea pigs and rabbits invariably gave rise to extensive pulmonary fat emboli. The possible mechanisms to explain this phenomenon are discussed.

F. J. LESEMANN, M.D.

ANESTHESIA

Leigh, M. D., and Belton, M. K.: Premedication in Infants and Children. *Anesthesiology*, 1946, 7: 611.

The advantages gained by premedication are important in infants and children as well as in adults. In addition, a most important factor in children is the curbing of a rapid exhaustive respiratory rate. This increased respiratory rate, sometimes over 100 per minute, is found especially in the unpremedicated infant who receives ether without due attention having been given to the elimination of carbon dioxide.

The postoperative nausea and vomiting frequently seen following preoperative medication with opiates may be offset to a large extent by adding one of the barbiturates. They are also most effective because they allay apprehension and prevent early convulsions.

There is a tremendous advantage in preventing the secretions in the respiratory tract by the use of drugs of the belladonna group. Scopolamine is more effective than atropine in this respect and has a longer duration of action. Atropine, on the other hand, is thought to reduce the dangers from vagal reflexes on the heart. A table is given in the original article showing the dosages of morphine and scopolamine or atropine for patients of 2 months of age and upward. This table gauges the dosage not only by the age of the child but also by the weight which may cause the dosage to vary considerably.

A warning is given regarding the measurement of the small doses of drugs. They should be dissolved in several cubic centimeters of sterile distilled water and thoroughly mixed so that the calculated dose can be more accurately administered.

Since any injection with a needle is painful it is best to give attention to details such as not allowing the child to see the needle, using sharp needles without barbs, allowing the alcohol to dry on the skin before injection, and by firmly pinching a generous part of the skin and subcutaneous tissues.

Morphine and scopolamine are given about an hour before operation, morphine and atropine one-half hour, and atropine alone one-half hour before operation. Barbiturates such as nembutal and seconal are given an hour before operation. MARY KARP, M.D.

Clement, F. W.: Nitrous Oxide-Oxygen Anesthesia. *Anesthesiology*, 1946, 7: 616.

The familiar terms, anoxia, anoxemia, and asphyxia are often confused or loosely applied. The

occurrence of anoxia is not confined to the administration of nitrous oxide alone, but may occur with any and all of the anesthetic agents. For many years the "oxygen exclusion" theory was accepted to explain the action of nitrous oxide in producing anesthesia. However, every anesthetist of experience has encountered cases in which the oxygen percentage in the nitrous oxide-oxygen mixture could be increased considerably above 20 per cent (which is roughly the normal air content of oxygen) and still maintain adequate anesthesia. Today the commonly accepted theory is that nitrous oxide itself possesses weak anesthetic properties.

All anesthetists should be familiar with the possible dangers of nitrous oxide-oxygen anesthesia. Nevertheless such dangers arise, not from the action of gas itself, but from its maladministration. "No anesthetic is safer than the one who gives it." The effects of anoxia have been evident after all types of anesthesia, but the anoxia state may be more readily produced with nitrous oxide-oxygen anesthesia than with other anesthetic agents, and the margin of safety is narrow.

Respiration is by far the most important sign during nitrous oxide-oxygen anesthesia. The patient is in no danger as long as he is breathing efficiently, i. e., machine-like respirations, inspiration and expiration about equal, the rate somewhat faster than normal, and continuous or uninterrupted with adequate volume. The greatest single hazard during nitrous oxide-oxygen anesthesia is the failure, once anesthesia has been established, to effect a gradual increase in the oxygen percentage of the mixture. The need for oxygen is usually very apparent because of the muscular responses of the patient. However, the weak, anemic, or debilitated patient does not necessarily show muscle spasm during deep anesthesia; in fact, flaccidity may occur. In such cases the danger signals are largely respiratory.

Once the desired depth of anesthesia is attained the oxygen concentration should be increased 1 per cent at a time while the effect of each increase on the level of anesthesia is noted. Failure to increase the oxygen supply as anesthesia progresses may well lead to fatal, or near fatal, degrees of anoxia.

During nitrous oxide-oxygen anesthesia the application of a simple and accurate test will reveal whether or not anesthesia is being maintained at a depressing level. This test is based upon the fact that whenever a patient in need of oxygen is given an abrupt and abundant supply, slowing of the respiratory rate or even temporary cessation of breathing occurs.

The duration of the apneic period is in direct ratio to the degree of oxygen deficiency. If at any time the anesthetist is in doubt regarding the depth of narcosis, he should administer one or two breaths of 100 per cent oxygen and observe the effect (if any) on the respiration.

The use of oxygen is not mandatory in the Army Air Forces until above the 10,000 foot level (14.25 per cent oxygen). Surely a patient, premedicated, asleep and quiet in anesthesia, can tolerate a comparable decrease of oxygen reduction.

Induction with 100 per cent nitrous oxide is advised for normal risk patients. For subnormal risk patients and children, a mixture of oxygen nitrous-oxide is advocated in order to decrease the possibility of inadvertent rapid production of the profound plane. No other anesthetic agent equals it in speed of absorption and elimination from the body. Also, it is free from the hazard of explosion.

MARY KARP, M.D.

D'Errico, G.: Intraosseous Anesthesia in Man (La narcosi endossea nell'uomo). *Gior. ital. chir.*, 1946, 2: 399.

The following advantages of intraosseous anesthesia have been pointed out by several writers:

1. It is possible to induce anesthesia with barbiturates in persons in whom superficial veins cannot be located.
2. Repeated doses of anesthesia may be administered without the need of a special apparatus to keep the needle in place.
3. The needle remains in proper position in spite of agitation of the patient.
4. The same needle may be used for transfusions of blood or plasma, or for the administration of saline or glucose solution.
5. The danger of a venous thrombosis is avoided.
6. The surgeon has the opportunity to supervise the anesthesia and even to administer it without help because the needle is located in a sterile, easily accessible field.

Endosternal anesthesia has been employed by the author in 19 cases. In 3 instances complications arose: in 1 case a subcutaneous aseptic abscess developed; in another, periostitis and osteoperiostitis of the sternum appeared following the anesthesia but subsided spontaneously within a few days; and in the third, a grave osteomyelitis of the sternum was attributable to the mode of administration of the anesthetic. The patient in the last case, a 46 year old man with syphilis, recovered after incision and drainage.

A 2.5 per cent solution of sodium pentothal was used for anesthesia. Preoperatively, morphine and atropine were given. In all instances the manubrium sterni was used as the site of injection and the usual precautions with regard to the preparation of a sterile field were taken. As an average, from 5 to 10 c.c. of the anesthetic solution were injected within 2 to 10 minutes, additional amounts being given from time to time according to the condition of the patient.

An infection following sternal puncture for anesthetic purposes may be caused by the introduction of pathogenic micro-organisms from the outside, or it may be attributable to bacteria which reach the sternum from the blood stream.

The occurrence of 3 complications in a group of 19 patients induces the author to condemn the sternal administration of an anesthetic.

JOSEPH K. NARAT, M.D.

Bishop, H. F.: Operating Room Deaths. *Anesthesiology*, 1946, 7: 651.

During the last few years the trend has been toward a full and impartial report on operating room deaths—a progressive step which is believed to be in keeping with the true scientific spirit.

In the line of progress, the operating room should be made a safer place for the patient to enter. Anesthesia societies have recently shown interest in the creation of anesthesia study commissions whose purpose it is to sift the facts impartially concerning operating room mortality.

In most instances death under anesthesia is the result of failure of circulation or respiration. Evidence bearing on the actual mechanism of death is frequently inconclusive. Goggio has attempted to distinguish between those cases in which the heart ceases to function because of asphyxia and those cases in which the heart stops in asystole or ventricular fibrillation.

Anesthetic drugs have been involved in 20 per cent of the deaths (caused by drugs) which have been reported to the medical examiner in the Boston area. These deaths under anesthesia were classified into the following subgroups: (1) aspirated vomitus; (2) serious preexisting disease of an inflammatory or degenerative nature; (3) sudden deaths on a neurogenic basis; (4) delayed deaths; (5) deaths without known cause.

Pressure over the carotid sinus should be avoided during anesthesia. A fatality may result if pressure is applied in this region of the neck on individuals who have a hyperactive sinus reflex which has been sensitized by certain anesthetic drugs such as nitrous oxide and morphine. Coronary occlusion may account for as high as 20 per cent of the sudden deaths occurring in adults undergoing operation.

The author presents a report on 6 deaths which occurred in the operating rooms of two hospitals with which he has been associated during the past 4 years. A total of 20,021 anesthetics have been administered during that time.

Case 1. A patient with suspected brain tumor was given avertin for an exploratory craniotomy. Respirations ceased before operation was started, and after 30 hours in a respirator, heart action ceased. The following management is suggested in such cases: trephine openings are made through the skull the day before operation. A ventriculogram is made on the morning of operation. The patient receives scopolamine premedication only. Just before the induction of anesthesia, the surgeon is asked to insert a brain cannula into each ventricle to reduce any increased pressure that may be present. In this way anesthesia induction is not commenced with an existing elevated pressure.

Case 2. A baby, 4 days of age, died at the completion of an operation for congenital atresia of the esophagus. No anesthesia was used, although oxygen was given during operation. It was believed that the amount of blood loss might have accounted for the shock and death of the infant. For babies, one should cut down on an ankle vein and tie an 18 gm. intravenous cannula in place before operation.

Case 3. Death occurred suddenly and unexpectedly in a 27 year old asthmatic patient while undergoing therapeutic stellate ganglion block. Death in this case might be explained by the observation of Cromer and Ivy who, following a series of experiments on dogs in 1933, reported that bilateral resection of the stellate ganglia sensitized the respiratory center to impulses rising in the vagus nerve and caused respiratory paralysis.

Case 4. The death of a 76 year old patient was attributed to fatal pulmonary embolism during manipulation of a hip fracture under anesthesia. Six similar deaths during manipulation have been reported to the author. It is difficult to understand how the type of anesthesia could have changed the outcome in these cases. On numerous occasions during manipulation for hip fractures (Leadbetter maneuver), the author has encountered sudden circulatory changes which were transient and were vaguely passed by as some type of reflex response.

Case 5. A 2½ year old child undergoing revision of a cleft palate under ether insufflation anesthesia died 30 minutes after the start of anesthesia. It was generally agreed that asphyxia was the cause of death. There has existed some opposition to the use of endotracheal tubes in infants and small children, but most writers are definitely in favor of them. It was believed that an endotracheal tube might have prevented this death.

Case 6. An 11 months old baby died during the repair of a harelip. It was considered that death resulted from asphyxia, caused by an error in the application of an endotracheal tube which was too long, and entered the right main bronchus.

Tragedies of this kind can serve some useful purpose if an exhaustive study is carried out on all operating room deaths.

MARY FRANCES POE, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Kooperstein, S. I., and Bass, H. E.: A Pulmonary Reaction following Intrabronchial Instillation of Lipiodol in Bronchial Asthma. *Am. J. Roentg.*, 1946, 56: 569.

The authors report that in a study of 40 cases of bronchial asthma including bronchograms as a part of the clinical investigation, 3 patients developed febrile illness with roentgen evidence of pulmonary infiltration. The lipiodol used in these cases was the commercial product, consisting of iodized poppy seed oil (40 per cent). Butyn sulfate, 2 per cent, was introduced intranasally, and anesthesia of the bronchial tree was attained by the gravity method. Lipiodol was swallowed to visualize both lower lobes and the right middle lobe.

Two of the patients developed an acute episode characterized by a rise in temperature, cough, expectoration, and malaise at the end of 9 and 12 days, respectively. The third developed an acute pulmonary episode characterized by chilly sensations, malaise, substernal pain, and cough. Roentgenograms of all 3 patients revealed bilateral basal densities which suggested the presence of pneumonitis in the areas of the distribution of the lipiodol except for an additional shadow of increased density in the upper right lung field of one of the patients. All of the cases showed an increase in the total white blood count and polymorphonuclear neutrophiles. Marked eosinophilia paralleled the course of the acute illness in 2 of the cases and was absent in the other. Two of the patients developed an urticarial eruption, one at the onset of the illness and the other 2 days after the bronchogram was taken.

Sensitivity tests were done on the 3 patients and 10 control cases with lipiodol, diodrast, poppy seed oil, and butyn sulfate (2%), respectively. All of the controls failed to react. The 3 patients reacted in varying degrees to diodrast and 2 of them reacted to scratch tests of lipiodol. None of the 3 reacted to the tests with poppy seed oil or butyn sulfate (2%).

The authors conclude that the 3 cases of bilateral pneumonia which followed lipiodal bronchograms offer evidence of having been caused by the lipiodol.

FRANK L. HUSSEY, M.D.

Schilling, J. A.: Perforation of a Duodenal Ulcer during Roentgen Examination. *Surgery*, 1946, 20: 730.

Perforation of a duodenal ulcer during fluoroscopic examination is fortunately very unusual. Fifty-seven cases have been reported that occurred either during or immediately following a barium study. The author's case falls in the first group.

During the routine fluoroscopic examination of a 72 year old white male who had had two large tarry stools 3 days previously, the barium suspension was seen to escape from the duodenal bulb and flow both to the right and the left and promptly outline the right lower boundary of the peritoneal cavity.

Fig. 1 (Schilling). Flat abdominal x-ray film taken at time of perforation. Note barium concentrations in the right and left lower quadrants. No barium is present deep in the pelvis or in the right subphrenic space.

Following laparotomy a 1.5 cm. perforation was found on the anterior portion of the duodenum. A large amount of black watery fluid was present, but the extravasated barium was fixed in small clumps and flecks by a fibrinous exudate. These flecks were distributed over all of the free peritoneal surface of the intestines and abdominal wall. Removal of the barium was impossible.

The patient's postoperative course was rather stormy. During the first 3 weeks there was considerable abdominal pain and diarrhea, and a large tender pelvic mass developed which subsided slowly. During the second month an eosinophilia averaging 23.5 per cent with a white blood cell count of from 10,000 to 20,000 developed, although the patient was essentially asymptomatic. A check-up examination after 6 months revealed essentially normal findings.

This case illustrates the route of spread of intraperitoneal effusions from the right subhepatic space. On the right side the effusion passes first to the right

infracolic space, then across the ascending colon and cecum to the right lumbar gutter or paracolic groove, then to the right subphrenic space. On the left side the subphrenic space is involved directly from the infracolic space and to a lesser extent from the left paracolic groove and both right and left subhepatic spaces.

Figure 1, taken at the time of perforation, illustrates both the avenues of peritoneal spread and the rapid and relative diffuse nature of the spread. Films taken 10 days later showed rather large amounts of barium in the right subphrenic space and in the deep pelvis. One hundred and thirty-nine days after the perforation there had been relatively little change in the distribution of the opaque material.

The microscopic distribution of intraperitoneally injected barium sulfate was studied in 3 dogs. Films made following the injection revealed the same rapid and diffuse spread of the solution and relatively little change in the distribution after the first few hours. Postmortem examination revealed the barium to be distributed throughout the entire peritoneal cavity. There were dense adhesions at the sites of the barium deposits, especially between the bowel loops and the parietal peritoneum. The mesenteric nodes were enlarged and contained barium. The lymphatics of the omentum and mesentery in 1 instance were clearly outlined with streaks of barium. Some of the thoracic nodes near the internal mammary vessels contained large quantities of barium. These nodes were observed on the antemortem roentgenograms. Microscopically, only moderate numbers of giant cells were present. There was round cell infiltration and fibrous encapsulation of small amounts of barium. In the omentum all of the barium was in either large single or multiple confluent macrophages.

R. B. Lewis, M.D.

Dann, D. S., and Koritschoner, R.: A Clinical Study of Normal and Pathologic Motor Activity of the Gall Bladder. Preliminary Report. *Radiology*, 1946, 47: 494.

The motor activity of the gall bladder was studied in 21 healthy apparently normal individuals.

Oral administration of sodium tetraiodophthalein resulted in good visualization in 16 cases, fair visualization in 2 cases, medium visualization in 1 case, and an absence of shadow on repeated examinations in 2 cases. One woman presenting good visualization did not return for postcibal films. The remaining 18 individuals pursued their normal daily activities and maintained their customary dietary habits following the roentgen demonstration of the gall bladder. Films were made over the gall bladder region 1 hour after each meal until the shadow of the dye completely disappeared.

Although a wide range in emptying rated normal was observed during the first 24 hours, there was no difference in the rate of emptying in the cases with fair and medium visualization compared to that in the cases with good visualization. One gall bladder required 48 hours for complete emptying although the meals were thought to be ample in fat, while another emptied completely after the first meal which contained practically no fat. In 2 cases there was no contraction following the first meal which was adequate in fat but the gall bladder responded satisfactorily after a second meal which was variable in its fat content.

Since the response of the gall bladder in these apparently normal individuals was so varied following meals of different fat content, the authors question the significance of the so-called "poorly functioning gall bladder," i. e., the normally visualized gall bladder with delayed or slow contraction following a meal containing fat.

R. B. Lewis, M.D.

Pereira, A.: Roentgen Diagnosis of Diseases of the Neck of the Bladder. *Am. J. Roentg.*, 1946, 56: 489.

The author presents a discussion of the anatomical conditions which cause the so-called disease of the bladder neck and their known syndrome.

The diagnosis of many of these conditions can be made by urethrocystography. Roentgenograms are made at the termination of filling of the urethra with a suspension of 15 to 20 c.c. of luxbarium (base, barium sulfate), an empty bladder having been previously filled with 60 to 80 c.c. of this opaque material. Oblique and anteroposterior films are taken. Three of the roentgenological images obtained correspond to anatomical conditions.

1. Image of the plane neck without protruding borders in both the profile and anteroposterior roentgenograms . It represents a hypoplasia of the sphincter itself. It corresponds to both congenital and acquired atrophy and to sclerosis of the neck. The differentiation between them can only be made by clinical examination in association with some roentgen characteristics of the prostatic urethra.

(a) In congenital atrophy the prostatic urethra is short or slender, and much elongated. Sometimes the colliculus seminalis is hypertrophied.

(b) In acquired atrophy the internal opening of the urethra is changed, but the prostatic urethra may keep its proportionate dimensions (coagulation of the neck, partial or total resection). In the atrophy of senile involution with reduction of the size of the prostate, obviously the prostatic urethra is shortened.

(c) In sclerosis of the bladder neck, shortening generally occurs because of the inflammatory retraction of the prostate gland.

The image is identical in the profile and anteroposterior roentgenograms. It shows a punctate smooth neck in the fundus of the bladder which does not change under anesthesia (operative verification).

2. Fish-mouth image. This represents exaggerated growth of the borders into the bladder cavity and corresponds to an exaggerated tonus of the sphincter. The image corresponds also to what is seen in the neck when the bladder is opened. But under local anesthesia more than under spinal or general anesthesia, the sphincter relaxes and the protrusion disappears. It is therefore a transitory image and exists only when there are attacks of hypertonia of the sphincter. In certain

diseases of the medulla the hypertonia becomes permanent and in that case the image persists and is not changed by any kind of anesthesia.

3. Image of hypertrophy of the trigonal muscle. Here the tissue which corresponds to the trigonal muscle is increased and tends to invade the bladder. In this growth it extends along the prostatic urethra and deviates the internal opening of the urethra so that it projects forward. As it is a progressive condition in the early stages, the prostatic urethra is not changed and the muscle protrusion is barely perceptible.

The roentgen image faithfully reproduces these appearances but only in the profile roentgenogram. The posterior border of the internal opening of the urethra grows forward and becomes superimposed on the anterior border, even forming a sort of valvular tongue.

In the anteroposterior roentgenogram taken in the advanced stages, the image may resemble that of adenoma of the median lobe in the beginning of its growth. When the hypertrophy of the median lobe coincides with hypertrophy of the trigonal muscle the image does not show anything characteristic, except the protrusion of the adenoma itself.

FRANK L. HUSSEY, M.D.

Soule, A. B., Jr.: Ossification of the Coracoclavicular Ligament following Dislocation of the Acromioclavicular Articulation. *Am. J. Roentg.*, 1946, 56: 607.

Ossification of the coracoclavicular-ligament following partial or complete avulsion of the ligament incidental to dislocation of the acromioclavicular articulation is apparently a common sequela of a relatively common type of injury.

In the series of 18 cases reported in this article, 14 of the patients with dislocation of the acromioclavicular articulation subsequently developed osseous deposits in the coracoclavicular ligament.

Dislocations of this joint are described as incomplete or complete, the latter term being applied when the coracoclavicular ligament is severed. In all dislocations there is tearing of the articular capsule and usually of the superior and inferior acromioclavicular ligaments, or both.

X-ray examinations of both shoulders in injuries to the acromioclavicular joints should be made with the patient in the upright position and a 20 pound weight in each of his hands. Widening of the injured joint and elevation of the acromial end of the clavicle is demonstrated in this way.

Ossification of the coracoclavicular ligament has been observed as early as 22 days following injury. It usually appears as a group of amorphous, cloudy areas of light density below the outer third of the clavicle, frequently near the conoid tubercle and usually closer to the clavicle than to the coracoid process. These areas increase rapidly in size and density and within several weeks take on definite characteristics of bone, being laid down in strands and spicules corresponding more or less to the lines of the fibrous strands of the conoid and trapezoid fasicule. While the bone frequently becomes attached firmly to the clavicle above, it approaches, but rarely becomes continuous with, the coracoid process below. The process of ossification appears to be progressive for a period of about 8 or 10 weeks and then shows no perceptible change on subsequent examinations.

If ossification had not appeared within 6 weeks following injury, it was not noted subsequently.

The production or absence of ossification appeared to have no relationship to motion in this series of cases, because in nearly all of the cases the shoulders were immobilized very shortly after injury.

Post-traumatic ossification of the coracoclavicular ligament is a common sequela of avulsion of the ligament associated with dislocation of the acromioclavicular articulation. The ossification appears between 3 and 6 weeks following the injury and becomes complete about 8 or 10 weeks following the injury. The ossification does not appear to contribute to the disability of the patients. FRANK L. HUSSEY, M.D.

Young, B. R.: The Roentgen Treatment of Bursitis of the Shoulder. *Am. J. Roentg.*, 1946, 56: 626.

During a 6 year period, 87 patients with bursitis were treated by radiation therapy. Patients were divided into three categories, according to the duration of their symptoms. Symptomatology of less than 1 week's duration was classified as acute. Pain and disability lasting between 1 and 8 weeks were classified as subacute. Symptoms enduring more than 2 months were considered chronic.

In all three groups, females outnumbered the males by 2 to 1. In the acute stage, the diagnosis was made on the basis of clinical findings of pain and limitation of motion, as well as local signs of heat and swelling. The diagnosis was more difficult in the subacute and chronic stages. Roentgen examination was necessary to establish or rule out calcification of the soft tissue or any other demonstrable pathology. The presence of calcification in itself was not too important. The history of the disease and the clinical findings were much more important for the evaluation of the activity of the disease. Calcium deposits were present in 43.6 per cent of the patients.

Roentgen therapy in the acute stage consisted of three treatments of 150 r. in air. Sometimes a fourth treatment was needed. Subacute cases were treated twice weekly for a total dose of 600 r. Therapy in the chronic cases varied. Twenty-nine were treated twice weekly for 2 weeks; 11 received weekly treatments for 8 weeks, and 8 were treated on 3 consecutive days with an additional treatment a week later.

Results of roentgen therapy in the treatment of bursitis of the shoulder indicate that this treatment is valuable in the acute and subacute stages. All but 2 patients in the acute stage were relieved of pain in a week or less. Two-thirds of the patients in the subacute stage reported relief from pain in 2 weeks or less. Only one-third of the patients in the chronic stage reported relief from pain. A second series of radiation therapy was never given to the patients with recalcitrant chronic bursitis. MAURICE D. SACHS, M.D.

MISCELLANEOUS

Buchta, J. W.: Radioactive Isotopes. *West. J. Surg.*, 1946, 54: 467.

The author briefly describes some of the basic physics of radioactive isotopes.

The atom of each element is composed of three fundamental particles: the electron, the proton, and the neutron. The electron is the smallest particle of negative electricity; its mass is about 1/2000 of that of the proton and neutron. The proton carries a positive charge equal in magnitude to that of the electron, the neutron has no electric charge. The mass of the proton is practically the same as that of the neutron.

The central core or nucleus of the atom contains definite numbers of protons and neutrons. Around the nucleus revolve electrons, their number always being equal to the number of protons in the nucleus. Thus the hydrogen, which is the simplest atom, has a nucleus containing a single proton and there is a single electron revolving around the nucleus. The helium has a nucleus composed of two protons and two neutrons and there are two orbital electrons. The iodine has a nucleus of 53 protons and 74 neutrons, and so forth.

The "atomic weight" of an element is approximately equal to the total number of protons and neutrons contained within the nucleus, whereas the total number of the electrons (and hence also of the protons) indicates the "atomic number" of the element. Thus hydrogen has an atomic weight of 1, and an atomic number of 1 (H_1^1), helium has an atomic weight of 4, and an atomic number of 2 (H_{e2}^4); iodine has an atomic weight of 127, and an atomic number of 53 (I_{53}^{127}). The chemical properties of the elements are determined by the atomic number, that is by the number and orbital arrangement of the electrons revolving around the nucleus and are quite independent of the nuclear structure. Therefore, it is possible for an element to have varieties with the same atomic number but different atomic weights. These varieties are called isotopes. For example, the oxygen with 8 orbital electrons, or an atomic number of 8, may have a nucleus of 8 protons and 8 neutrons (O_8^{16}), a nucleus of 8 protons and 9 neutrons (O_8^{17}), or a nucleus of 8 protons and 10 neutrons (O_8^{18}). Most of the elements have stable isotopes; tin has 10. Since the isotopes of a given element have identical chemical behavior, they can be separated only by some other method than ordinary chemical process as, for example, by diffusion or electrolysis.

Radioactivity involves disintegration of the nucleus which may occur naturally in some of the heavy elements or may be induced artificially by nuclear transformation in every element of the periodic table.

The rate of disintegration cannot be influenced. The half lives of the radioactive products vary from a fraction of a second to millions of years. The uranium has the longest half life of all and is most abundant.

The number of radioactive isotopes already exceeds 300. All the elements of the periodic table have at least one radioactive isotope, and some have more than one-half dozen.

During the disintegration process of a radioactive isotope, electrons or (rarely) positrons are emitted, not infrequently accompanied with gamma rays.

An extremely sensitive apparatus for the detection of radioactivity is the Geiger counter which registers every single ionizing particle in the form of a "click." The number of clicks per minute is an indicator within certain limits of the strength of the radioactivity. If one drinks radioactivated salt water the Geiger counter will detect the presence of radioactive sodium in the hand within a quarter of an hour. A similar procedure can be used for tracing a radioactive substance in any part of the body.

The many possibilities of tracer studies are immediately obvious. Reports have already been published on the usefulness of more than a dozen tracers in all types of biologic experiments.

Up to the present, radioactive isotopes have been produced in comparatively small quantities through bombardment with the cyclotron or with the aid of intensive sources of natural radioactive substances. Now, the use of the uranium pile, which yields enormous numbers of neutrons permitting a very efficient nuclear transmutation, has considerably increased the availability of nearly every radioactive isotope. Another valuable supply is obtained from the contamination fission products of the atomic bomb pile.

T. Leucutia, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Andreae, W. A., and Browne, J. S. L.: Ascorbic Acid Metabolism after Trauma. *Canad. M. Ass. J.*, 1946, 55: 425.

The authors summarize briefly what has been known about ascorbic acid, wound healing, and callus formation, and then report their own studies which were done on patients with a normal vitamin C intake, and not, as most previous studies, on patients with vitamin C deficiency.

They find that patients after trauma (fractures, burns) require considerably more ascorbic acid in order to become saturated with it than do normal persons. Their needs resemble those of patients with experimentally induced scurvy. However, while in the scorbutic individuals such increased vitamin C intake is necessary to promote wound healing, no significant clinical effect of saturation doses of ascorbic acid is found in traumatized patients with an initially approximately normal vitamin C status.

HEINRICH LAMM, M.D.

Huet, P., and Huguier, J.: The Probable Role of Reflex Capillary Stasis in General Pathology (Le rôle probable de la stase capillaire réflexe en pathologie générale). *J. chir.*, Par., 1946, 62: 184.

The authors contend that all trauma provokes reactions which are generally admitted to be of a reflex nature, and that local reflex reaction is the constant means by which the organism reacts to aggression of any sort at any site.

Following trauma a local reflex capillary stasis occurs, with increased arterial pulsations proximal to the site of trauma comparable to those which occur proximal to any arterial obstruction. Capillary stasis rapidly induces serous exudation which is manifested by edema, blisters, and joint effusion. If the stasis is intense local diapedesis and even hemorrhage may occur. Sympathectomy, by producing active hyperemia, relieves the local capillary stasis.

Assuming that diffusion of reflexes is a common phenomenon, the authors suggest that the general reactions to trauma such as shock may represent in effect a diffusion or spread of the local reflexes to produce a peripheral vasomotor stasis.

EDWARD W. GIBBS, M.D.

Holubec, H.: An Improved Intravenous Treatment of Intestinal Occlusion. An Experimental Study (Úprava vnitřního prostředí u střevní neprůchodnosti. Experimentální studie.). *Lék. listy*, 1946, 1: 106.

The rapid infusion of large quantities of physiologic saline solution has been observed to result in degeneration of the cardiac muscle and kidney parenchyma, eventuating at times in circulatory failure and even in anuria. Likewise Ringer's solution leads at times to edema.

The author in studying the method of injecting plasma with the physiologic saline solution, as recommended by Gendel and Fine (*Ann. Surg.*, 1940, 111: 248), employs the exact technique of the American authors. However, a closer study of blood conditions during the experiment convinces him that the early losses in water and electrolytes, and the later loss of plasma from the blood in experimental insufflation distention of an isolated segment of small bowel, together with reduction in the albumin-globulin ratio, denotes a change in the eucolloid conditions in the blood plasma, rather than the previous explanations on the basis of humoral changes in the blood.

The coincidental injection of plasma and physiologic saline solution permits of the use of smaller quantities of the latter, and is thus regarded as a definite improvement in the treatment of ileus.

JOHN W. BRENNAN, M.D.

McKittrick, L. S.: Recent Advances in the Care of Surgical Complications of Diabetes Mellitus. *N. England J. M.*, 1946, 235: 929.

The general safety of all patients undergoing surgical procedures has been increased immeasurably during the past few years, and although diabetic patients necessitate special attention to their local and general surgical conditions as well as their diabetes mellitus, recent experience has shown that their metabolic disorder is no contraindication to any surgical procedure. Surgical emergencies should be avoided as much as possible in order to insure the safest possible convalescence. This discussion of diabetic surgery deals with problems involved in operations accounting for about two-thirds of the surgery performed on diabetics at the New England Deaconess Hospital. These operations were necessary for infections of the skin and subcutaneous tissues, especially carbuncles, and for gangrene and infection of the lower extremities.

Among 95 patients operated on for carbuncles between 1928 and 1941 there were 7 deaths. This, however, gives little concept of the seriousness of this condition to the diabetic. The recently instituted treatment of carbuncles with penicillin (from 100,000 to 300,000 units daily for from 7 to 10 days) has been most gratifying. This results in the disappearance of large early carbuncles or the change of advanced infections to small painless fluctuant areas which heal promptly after local incision. Penicillin has reduced materially the morbidity, mortality, and the period of hospitalization in these cases.

Diabetic patients with carbuncles should be treated as emergency cases, hospitalized immediately, have careful management of their diabetes, and receive daily injections of penicillin. When the carbuncle is so

advanced that penicillin fails to cause complete disappearance and leaves a small central area of necrosis, it may be treated by a small incision followed by packing with gauze for 1 or 2 days. Small carbuncles that fail to resolve completely are best treated by complete excision and early skin grafting. Extensive operations such as were previously done for carbuncles are necessary only in the badly neglected cases. Parenteral administration of penicillin is superior to local or oral use.

The mortality of major and minor leg amputations in diabetic patients between 1923 and 1942 before the use of sulfonamides or penicillin was 9.7 per cent (1,036 cases) as compared to 2.6 per cent (229 cases) since the use of antibiotic and chemical therapy. This remarkable improvement is attributed solely to the increasing ability to eliminate infection.

The supracondylar type of amputation is the safest and easiest, the lower leg type and the Gritti-Stokes operations being reserved for selected cases. Guillotine amputation is indicated for patients in poor condition or those with extensively spreading infection, but it is now rarely required.

When infection can be controlled in the diabetic patient a more conservative operation can be done. The transmetatarsal amputation is now used, but formerly it was not feasible because of the danger of invasive local infection and septicemia. Seventy-five metatarsal amputations have been done in the past 2 years; in 11 cases they failed and in 1 case the patient died of coronary disease. Indications for this type of operative procedure are not yet clear. Occasionally a small area of necrosis occurs on the dorsal flap. The importance of penicillin is recognized when one realizes that in 75 routine cultures from this group the Staphylococcus aureus was present in pure cultures in 11 cases and in combination with other organisms, usually streptococci, in 41 instances. Experience has shown that amputation at the metatarsal level is practical and safe with the use of penicillin and gives a better functional result than when done at a higher level in the leg. The author estimates that from 10 to 15 per cent of this group would have required amputation at a higher level prior to the use of penicillin.

A further advantage in technique is the suture of the operative site leaving only a small part open for drainage following removal of one or several toes when the foot is split longitudinally. This results in a smaller scar and decreases the healing time.

Procaine spinal anesthesia is best, and no justification is found for the use of refrigeration anesthesia. Preoperative sedation is not given to these patients since it is believed unnecessary and at times dangerous.

C. Frederick Kittle, M.D.

Cordier, G., and Demirleau, J.: The Use of Animal Plasma or Serum in Man. Universal Detoxified Plasma or Serum (L'utilisation du plasma ou sérum animal chez l'homme. Plasma ou serum universel détoxiqué). *Presse méd.*, 1946, 54: 883.

During the last war, the supply of human plasma or serum for transfusion presented a difficult problem for the French Army fighting in Tunis as the Mohammedan soldiers refused to donate blood. Based on an article by Donald Edwards in the *Britsh Medical Journal*, the author developed a method of using animal plasma for transfusion purposes. Bovine plasma was used as it has the greatest similarity to human plasma in its protein content. The blood was drawn from living cattle which were at the slaughter house.

In order to detoxify the plasma, the globulins have to be removed from the blood as the antibodies attached to the globulins seem to be the cause of untoward accidents in transfusion. The citrated blood is kept for 2 days at room temperature in the dark, then centrifuged for 15 minutes. The plasma is then filtered through cotton and muslin, 0.2 per cent formalin and 0.34 per cent ammonia are added, and the serum is kept in a water bath at 74°C. for 30 minutes.

The author's experiences are still rather limited (about 100 cases), but the results were most encouraging. In only 3 cases were reactions observed with chills and hyperpyrexia. The amount of transfused plasma averaged 400 c.c., although some patients received as much as 1,000 c.c. without any reaction. In several cases, the transfusion was repeated after 10 to 15 days without any signs of anaphylaxis. It is important to make the transfusion very slowly.

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